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[Belanovskiĭ (I.).] **Белановский (И.). Laws of the Mass Increase of Insect Pests and Meteorological Factors.** [*In Russian.*]—*Zool. Zh.* **15** no. 2 pp. 187–216, 73 refs. Moscow, 1936.

The author criticises the theory that sharp variations in insect populations may be ascribed to ecological influences to the practical exclusion of biotic and physiological factors [*cf. R.A.E.*, A **17** 489]. He reviews in some detail the literature since 1913 on the problem of insect populations, and gives instances of phenomena in the life of insects that cannot be explained by climatic influences. These include the types of diapause that occur at different seasons, or are prolonged for different periods, in individuals of the same species ; the often very extensive area over which an insect may increase suddenly, notwithstanding divergent climatic conditions ; fluctuations of insect populations that show a regular periodicity ; and finally, variations in fertility, and in the vitality of the progeny, of whole generations, unconnected with external factors. He considers that catastrophic variations in population should be ascribed to variations in egg-production and in the vitality of the succeeding generation, two variations that often accompany each other. Different species show different ways of accumulating and releasing the energy required for an expansion of population. Some expend this energy regularly, while others accumulate it for several generations and then expend it in one eruption. It follows from these considerations that the phenomena of insect life are as much under the influence of internal as of external factors, and that the interaction of these varies for each species and each individual case. No laws of insect dynamics can be established without a deeper study of insect physiology and genetics. Physiological constitution is the result of the action of environment over a long period of time, so that the internal influences may be considered the product of the external, viewed historically. It is not questioned that such external factors as drought, late spring frosts or exceptional precipitation may exercise a negative influence on the expansion of an insect population, but in very few cases has a positive influence been demonstrated. Thus, external factors cannot be held wholly responsible for mass increases in population, or, in many cases, for catastrophic reductions. Internal factors, the influence of which is to a greater or less degree independent of the external conditions of a given moment, must also be taken into consideration.

[Kozhanchikov (I. V.).] **Кожанчиков (И. В.). Zur Frage über das Temperaturoptimum des Lebens. VII. Physiologisches Kriterium der Steno- und Eurythermie der Insekten.** [The Question of the Vital Optimum Temperature. VII. A physiological Criterion of Steno- and Eurythermy in Insects.] [*In Russian.*]—*Zool. Zh.* **15** no. 2 pp. 217–244, 7 figs., 17 refs. Moscow, 1936. (With a Summary in German.)

An account is given of investigations in Leningrad on the relationship between the reaction of respiration in insects to temperature and the thermal conditions of their habitat. Periodical temperature measurements were taken at various levels above and below the surface of a meadow, the ground in a wood and the surface of a pond, and investigations were made in the laboratory on the respiratory processes

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of various stages of insects from these environments. Two factors were considered, *viz.*, the intensity of respiration (amount of oxygen consumed per hour) at different temperatures, and the amount by which this intensity changed with changes in temperature. The results, which are tabulated for many species, showed great diversity, so that no general rule could be formulated, but two broad tendencies were distinguishable, with many intermediate stages corresponding to the infinite variations of ecological conditions. Firstly, the consumption of oxygen by certain larvae that live in soil or in deep water rose steadily as the temperature rose from 17·5 to 25 or 30°C. [71·6 to 77 or 86°F.] and thereafter declined, whereas the amount of change of oxygen consumption either decreased as the temperature rose, giving negative values after maximum respiration, or reached a maximum at 20 or 25°C. [68 or 77°F.] before declining, its curve then running parallel to that of the oxygen consumption. In this case, no regulatory reaction to extremes of temperature is shown. Secondly, though certain of the insects that live overground or near the surface of water showed a reduction in the amount of increase of respiration at medium temperatures, or even a reduction in its intensity, most of them showed a pronounced increase in the consumption of oxygen in proportion as the temperature rose. Insects of this type are considered to show a regulatory reaction to temperature variations. Insects of a species or stage of development that occur in an environment in which the temperature varies considerably possess this regulatory faculty, whereas those that live under stable temperature conditions do not. The degree of development of the reaction, as manifested by respiration tests, thus serves as a criterion of the degree of eurythermy of the species or stage. The intensity of the reaction is affected, however, by many factors, such as temporary lack of food and short exposure to abnormal temperatures.

[Smirnov (E.) & Polezhaev (V.).] **Смирнов (Е.) и Полежаев (В.). Ueber die Einwirkung von Blausäure und Chlorpikrin auf das Hypopialstadium von *Glyciphagus destructor* Schr.** [The Effect of Hydrogen Cyanide and Chloropicrin on the Hypopi of *G. destructor*.] [*In Russian.*]—*Zool. Zh.* **15** no. 2 pp. 340–348. Moscow, 1936. (With a Summary in German.)

Experiments carried out in Moscow, in which laboratory-reared immobile hypopi of *Glycyphagus destructor*, Schr., which infests stored grain, were exposed for varying periods to a 5·8 per cent. concentration of hydrocyanic acid gas, showed that this stage of the mite is very resistant to the gas, emergence of deutonymphs taking place even after exposure for 12 days. Exposure for 6 days appeared to have some effect on emergence, but only after this period was mortality sensibly increased. The results of three series of tests are tabulated, but as they varied considerably, no rule could be formulated. Other stages of *G. destructor*, including the mobile hypopus, did not show this resistance, and the immobile hypopi were not resistant to chloropicrin, a 13·4 per cent. concentration giving 50 per cent. mortality after an exposure of 2 days. The question requires further investigation, as other mites may show the same resistance to HCN, which has been recommended for their control.

ANDERSEN (K. T.). **Wie prägt sich der verschiedene Lebensraum der Freiland- und Vorratsschadinsekten in ihrem biologischen Verhalten aus ?** [How does the Difference on Environment of out-door Pests and Store Pests impress itself on their biological Behaviour ?]—*Nachr. SchädlBekämpf.* **11** no. 4 pp. 153–170, 6 figs., 8 refs. Leverkusen, December 1936.

On the basis of a comparison of the bionomics of *Calandra granaria*, L., and *Sitona lineata*, L., made partly from his own observations [*R.A.E.*, A **22** 719; **23** 300, etc.], the author shows how the difference of their environment affects the fertility, mortality, feeding habits and life-cycle of stored-product and out-door pests in general.

KRAMER (O.). **Auftreten und Bekämpfung einer Spinnmilbe im württembergischen Weinbaugebiet.** [The Occurrence and Control of a Spinning Mite in the Württemberg Vine-growing Region.]—*Nachr. SchädlBekämpf.* **11** no. 4 pp. 183–189, 1 fig. Leverkusen, December 1936.

A mite, thought to be *Bryobia praetiosa*, Koch, that was first observed on grape vines in Württemberg in 1931 had become numerous by the autumn of 1933. In 1934, when infestation reached its highest point, owing to a warm dry spring, the eggs were hatching from late March until about 20th April, and the first adults appeared in mid-May. In 1935, the mites did not become active so early. Temperatures as low as −15°C. [5°F.] have occurred in two successive winters but have not affected the eggs. The infested leaves are crinkled. In laboratory experiments with various sprays, it was found that the eggs are most easily killed when they are almost ready to hatch. At this time, however, it is unsafe to apply a tar distillate or winter-strength lime-sulphur, and, though these sprays are of some value if applied earlier, better control has been obtained by spraying with a 2 per cent. lime-sulphur as soon as the buds appear and the eggs have hatched.

VON OETTINGEN (H.). **Biologie und Statistik einiger Thysanopterenarten.** [A biological and statistical Study of some Thysanoptera.]—*Nachr. SchädlBekämpf.* **11** no. 4 pp. 189–198, 8 figs., 13 refs. Leverkusen, December 1936.

Statistical data are given on the prevalence in the meadow lands of the river Warthe, Prussia, of different stages of *Limothrips denticornis*, Hal., *Chirothrips manicatus*, Hal., and *Aptinothrips rufus*, Gmel. They are based on the results of net sweepings made regularly over a period of years, and some conclusions on the biology of the thrips are drawn from them. It appeared that *L. denticornis* has usually only one generation, in summer, but may sometimes produce another in autumn. It is favoured by rain. *C. manicatus* has two generations a year, and its numbers decrease with a rise in humidity. *A. rufus*, which is common on moors and in cereal fields, was absent in some years in the meadows, but in others it was the most abundant species. It can hibernate as a larva and appears early in spring if the weather is warm and moist.

BERAN (F.). **Zur Kenntnis der Obstbaumkarbolineumemulsionen II. Teilchengrösse und insektizide Wirkung.** [A Contribution to the Knowledge of Fruit-tree Carbolineum Emulsions. II. Droplet Size and insecticidal Action.]—*Anz. Schädlingsk.* **13** no. 1 pp.1–3, 3 figs., 5 refs. Berlin, January 1937.

From the same tar distillate that he had employed in tests of disintegration time [*R.A.E.*, A **24** 345], the author prepared five emulsions of different droplet size, obtained by different methods of mixing or by incorporation of small amounts of magnesium chloride. In the one with the largest droplets, the maximum size was 20μ and the average 1–2μ; while in the one with the smallest droplets, the maximum size was 1μ and the majority were invisible under the microscope. All five emulsions were used in field tests in Austria against *Lecanium corni*, Bch., on plum and *Robinia*, and three against *Epidiaspis leperii*, Sign., on apple. It was found that the insecticidal action was decreased with large droplets, so that the highest possible dispersion should be obtained in preparing emulsions.

LIEBERS (R.). *Aphomia gularis* **Zeller in einer rheinischen Süsswarenfabrik.** [*A. gularis* in a Rhenish Confectionery Factory.]—*Anz. Schädlingsk.* **13** no. 1 pp. 7–11, 6 figs., 14 refs. Berlin, January 1937.

Aphomia gularis, Zell., which had been observed in Hamburg in 1932 [*R.A.E.*, A **21** 176], was found in western Germany in December 1935, when it was taken in a room in a confectionery factory in which sweet almonds were kept. The eggs, larvae and adults of both sexes are described. Fertilised females lived for 12–14 days at 20–22°C. [68–71·6°F.] and unfertilised ones for 2–3 days longer. About 66 per cent. of the adults were females. These laid from 10 to 30 eggs, but in a subsequent series of breeding experiments the numbers were 150–250. At 30°C. [86°F.] and 70 per cent. relative humidity, the eggs hatched in 4–5 days. The larvae were reared on almonds. After a wandering stage of 6–20 days, they spun close, firm cocoons and pupated a few days later. The cocoons occurred in groups of 8–12 spun together. Pupae placed early in January in an incubator at 29–30°C. [84·2°–86°F.] produced adults from the end of February to early April. There was considerable mortality in the larval and pupal stages.

[KAMISHNIĬ (M. S.).] **Камишний (М. С.). About Zones of Mass Multiplication of Hessian Fly.** [*In Ukrainian.*]—*Bull. Ukr. sci. Res. Inst. Grain Cult. Dep. Ent.* no. 2 pp. 5–63, 41 maps, 124 refs. Kiev-Kharkov, 1935. (With a Summary in English.)

Records from 1847 to 1934 of the distribution of the Hessian fly [*Mayetiola destructor*, Say] in the Russian Union, especially the Ukraine, and the damage caused to wheat are surveyed. The fly occurs throughout European Russia, with the exception of the Departments of Olonetzk, Archangel, Orenburg and Astrakhan, and also in parts of Transcaucasia, western Siberia and Central Asia. The fact that it is found under a great variety of climatic conditions is evidence of its very high biotic potential. It is constantly present in small numbers in all localities within the area of its distribution, but becomes a pest only when

there is a favourable conjunction of meteorological and agricultural factors. The eggs and the newly hatched larvae are the most susceptible stages to any unfavourable conditions, especially desiccation ; instances have been observed in which all larvae that had not reached the sheaths of the leaves were killed at a relative humidity of 50–60 per cent. and a temperature of 20–25°C. [68–77°F.]. On the other hand, heavy rain may wash over 80 per cent. of the eggs from the leaves. The area of constant and often very severe outbreaks is almost confined to the Ukraine and occupies a strip that passes north of Odessa and includes Kharkov. Outbreaks are frequent in the rest of the Ukraine, part of the central Black Soil Zone, northern Caucasus and northern Crimea, occasional in the central Departments of European Russia, and very rare in the rest of the area of distribution of the fly. The zones of its mass occurrence coincide with the Black Soil Zone, the constant presence of couch grass [*Agropyrum repens*], and the area of the cultivation of winter and summer wheat.

[Klokov (E. V.).] **Клоков (E. B.). About the System of Measures in Hessian Fly Control.** [*In Ukrainian.*]—*Bull. Ukr. sci. Res. Inst. Grain Cult. Dep. Ent.* no. 2 pp. 64–177, 7 graphs, 121 refs. Kiev-Kharkov, 1935. (With a Summary in English.)

With a view to evolving a system of measures against the Hessian fly [*Mayetiola destructor*, Say] on wheat in the Ukraine and the Crimea, data on its control in the Russian Union and elsewhere are summarised and experiments in the Ukraine are described. Since the maximum loss of crop results from infestation of the young plants in the phase of the first two leaves, any cultural measures that improve the growth of the crop and accelerate the appearance of the third leaf and the beginning of tillering are of great value. Special attention should, however, be devoted to the destruction of the stubble to prevent emergence of the flies from the puparia. This should be done before winter crops are sown in the neighbourhood and is best effected by ploughing to a depth of 6–8 ins. Destruction by fire is, however, possible if there is enough dry straw in the field and weeds are scarce. Self-sown wheat should also be destroyed. It is not generally practicable to sow winter wheat late enough to avoid infestation in autumn, except in some districts in the south of Russia. As observations have shown that infestation is often sporadic and that the adults may fly for a distance of a little over a mile, summer wheat should be sown as far as possible from infested winter crops.

Experiments with dusts and sprays designed to kill the eggs and young larvae were carried out on autumn- and spring-sown wheat in pots or field plots, and the results were estimated by comparison with untreated plants. Soap was added to all sprays as a spreader. The following were the percentage controls obtained with the more effective insecticides, the figures in brackets showing the percentage concentrations of the latter in the sprays or dusts : 74·3–99·2 with anabasine sulphate (0·1 spray) ; 60·6–94·1 with nicotine sulphate (0·1–0·15 spray) ; 80–86 with sodium fluoride (0·75–0·8 spray) ; 91·8 and 96·6 with anabasine sulphate (2·5 and 5 dust, respectively) ; 92·4–94·1 with anthracene (10 dust with lime). The rate of the application per acre depends on the size of the plants ; about 40 gals. spray or 20 lb. dust is sufficient for sprouting wheat. Two applications should be made during the period of mass oviposition of the fly,

with an interval of 4–7 days. Other measures recommended are destruction of *Agropyrum repens*, which is an alternative food-plant, stacking and threshing wheat as soon as possible after harvest to prevent emergence of flies from the straw, and sowing to a depth of about 2 ins., which helps the formation of the second tillering node.

Of the crops attacked, those that suffer most, in the descending order of preference, are autumn-sown wheat, the soft varieties of spring-sown wheat, and spring-sown rye; whereas autumn-sown rye, hard varieties of wheat, and barley are infested but slightly, and oats are attacked least of all. In the eastern part of the Ukraine, and apparently in northern Caucasus, the substitution of hard varieties of spring-sown wheat for the soft ones is of great importance in the control of the fly.

[Zagovora (O. V.).] **Заговора (О. В.).** *Oria musculosa* **Hb. in the Ukraine.** [*In Ukrainian.*]—*Bull. Ukr. sci. Res. Inst. Grain Cult. Dep. Ent.* no. 2 pp. 178–201, 29 refs. Kiev-Kharkov, 1935. (With a Summary in English.)

Much of the information in this paper on *Oria musculosa*, Hb., attacking cereals in the Ukraine has already been noticed [*R.A.E.*, A **23** 566]. The larval instars of this Noctuid are described, and its bionomics and cultural measures for its control are discussed. The larvae begin to hatch from the overwintered eggs when the mean day temperature reaches 6–8°C. [42·8–46·4°F.], which it may do as early as March or as late as mid-May. The hatching period usually extends over two weeks, and the larval stage lasts about 50 days. Newly hatched larvae can remain for 4 days without food, but though they are very active, they do not migrate far from the place of hatching. The larvae live inside the stems until they reach the fourth instar and then attack the ears; they are, however, responsible for the formation of only a small proportion of white ears. The adults are usually most numerous in mid-July. The number of eggs laid by a female varies from 98 to 354, with an average of 239, the oviposition period lasting 3–12 days. The adults do not fly far and usually concentrate in and near the place of emergence. Most of the eggs are laid in the sheaths of the leaves on the upper and middle part of the stems of cereals and some on stubble and grasses.

[Yastrems'ka (L. O.).] **Ястремська (Л. О.).** *Zabrus tenebrioides* **Goeze and Methods of its Control.** [*In Ukrainian.*]—*Bull. Ukr. sci. Res. Inst. Grain Cult. Dep. Ent.* no. 2 pp. 202–223, 1 fig., 18 refs. Kiev-Kharkov, 1935. (With a Summary in English.)

During the years 1931–34, the larvae of the Carabid, *Zabrus tenebrioides*, Goeze, caused serious injury to young cereals in districts of the Ukraine on the right bank of the Dnieper. Most of the damage was done in 1931 and 1932, when more than 40 districts were infested, and the crops were completely destroyed or severely injured over areas of about 18 and 27 sq. miles. Special investigations on control were therefore carried out.

The larvae drag the leaves into their burrows and reduce them to a mass of hair-like fibre; in the author's observations they always first attacked the leaves near the base, and not at the tip [*cf. R.A.E.*,

A **20** 486]. Besides cultivated and self-sown cereals, couch grass [*Agropyrum repens*] was readily attacked, and stubble fields containing this weed were more heavily infested than those from which it was absent [*cf.* **17** 429]. Other graminaceous weeds were ignored. In laboratory experiments, the larvae preferred summer wheat to barley, and seldom attacked oats. Adults damaged about 22–25 grains of wheat each in 10 days. When larvae of the first and second instars were present in a winter crop at the rate of about 17 per sq. yard in autumn, they destroyed 40–50 per cent. of the plants, and bare patches appeared in spring. Such patches were already evident before the winter if there were 40–50 larvae per sq. yard. As experiments showed that larvae of the first and second instars can withstand starvation for about a week and a fortnight, respectively, an infested field should not be used for an autumn-sown crop unless it has been cultivated at least 25 days previously and cleared of self-sown cereals and couch grass. Infestation was invariably lowest in fields that had lain fallow. In plots to be sown in spring, the stubble should be ploughed not later than the end of September or beginning of October. Migration of the larvae from the edges to the centre of a field has been effectively prevented by trenches with steep sides. They must be 12 ins. deep and at least 6½ ft. from the infested strip.

In experiments with insecticides against the larvae, dusts proved more effective than sprays, but the most effective dust, a mixture of calcium arsenite and lime (1 : 4) applied at the rate of 18 lb. per acre, only gave 25·4 per cent. mortality of larvae in the third instar in spring and 49·5 per cent. of larvae in the first and second instars in November. Poisoned baits of wheat chaff or the green parts of wheat moistened with a 7·5 per cent. solution of sodium fluoride or a 2·5 per cent. solution of sodium arsenite killed the larvae in trap trenches, but were not touched when broadcast among plants in the field.

[Kamishnĭ (M. S.).] **Камишний (М. С.). A new Pest—the Grain Beetle.** [*In Ukranian.*]—*Bull. Ukr. sci. Res. Inst. Grain Cult. Dep. Ent.* no. 2 pp. 224–230, 5 figs., 3 refs. Kiev-Kharkov, 1935. (With a Summary in English.)

In 1932 and 1933, considerable damage to wheat in southern Ukraine, especially on the left bank of the Dnieper, was caused by the larvae of *Dolichosoma lineare*, Rossi. This Dasytid, the adult and larva of which are described, is widely distributed in the Russian Union and common in the Ukraine, but has not previously been recorded as a pest. The adult beetles apparently feed on pollen ; in the district of Kharkov, they occurred in June–August, on cereals, grasses, leguminous field crops and beet. The place of oviposition has not been ascertained, but there is some evidence that eggs are laid at the time of the maturation of the grain, possibly on the ears. The larvae shun light and are very active, covering a distance of 12 ins. in a minute on an even surface. When they have completed the first instar (in which their habits are not known), they feed on the maturing or ripe grains of cereals ; after harvest they feed on fallen grains and especially on those that are still present in the ears of plants left lying on the ground. With the beginning of cold weather, they penetrate into the lower part of the stubble and remain there for hibernation. In one locality, however, they did not occur in the stubble in September, but were found in the soil. Pupation takes

place in the spring. The beetle does not cause any significant injury if the crop is harvested properly ; it became a pest because the cut wheat was left in loose heaps in fields for a month or more, and during this period the larvae damaged 29–53 per cent. of the grains. Barley was less severely injured. Control is simple and should consist chiefly of thorough and rapid harvesting and threshing of the crop. The fields should be ploughed to a depth of at least 7 ins.

[Kamishniĭ (M. S.).] **Камишний (М. С.). The Millet Fly—a new Pest of Millet in the Ukraine.** [*In Ukrainian.*]—*Bull. Ukr. sci. Res. Inst. Grain Cult. Dep. Ent.* no. 2 pp. 231–237, 1 fig., 2 refs. Kiev-Kharkov, 1935. (With a Summary in English.)

The Cecidomyiid, *Stenodiplosis panici*, Plotnikov, infested the grains of millet [*Panicum miliaceum*] in several districts of the Ukraine in 1932 and 1933, and caused severe damage in 1934 in the steppe zone in the south. The larvae hollow out the seeds and pupate in them. The adults, which are described, appear from the end of May and are present in millet fields from the beginning of July. They live for about 5 days and deposit their eggs under the husk of the grains at the time of ripening. In 1934, they were still active as late as the end of September. The development of a generation is completed in 15–20 days, and 3–4 are produced in the summer. The insect also attacks barnyard grass (*Panicum crus-galli*), on which it breeds in spring and autumn when cultivated millet is not available, and in the seeds of which it possibly hibernates. The outbreak of 1934 was due to the unusually early and dry spring, which favoured the development of *P. crus-galli* and caused the millet to sprout at different dates, so that plants of different stages of development occurred together ; moreover, owing to the drought, the sowing of millet was very much delayed in many localities. In some districts the yield was reduced by 60–90 per cent.

Fields to be used for millet should be at a distance from places where barnyard grass is the prevalent weed and should be ploughed deeply. The crop should not be sown late and sowing should be completed quickly to secure uniform maturation. Barnyard grass in millet fields and the adjoining area should be destroyed two or three times during the summer.

[Strel'nikov (I. D.).] **Стрельников (И. Д.). Die Sonnenbestrahlung und das Mikroklima in der Oekologie von** *Loxostege sticticalis*. [Solar Radiation and Microclimate in the Ecology of *L. sticticalis*.] [*In Russian.*]—*Bull. Inst. sci. Leshaft* **19** fasc. 1 pp. 1–76, 11 diagr. (3 fldg.), 18 refs. Leningrad, 1935. (With a Summary in German.)

These studies on adults and larvae of *Loxostege sticticalis*, L., were made in the same way as previous ones on *Locusta migratoria*, L. [*R.A.E.*, A **24** 312] and were carried out in the summers of 1933 and 1934 in the Kalmuik Province (former Department of Astrakhan), and the Orenburg district. The records showed that the body temperature of the larvae and adults rises rapidly under the influence of solar radiation, sometimes reaching 45–47·5°C. [113–117·5°F.] and exceeding the temperature of the air by 13–20°C. [23·4–36°F.]. The increase is limited by the intensity of the radiation, the air temperature,

wind and evaporation. The heat caused by radiation is rapidly lost by adults in the shade, the body temperature then approaching that of the air. The passage of clouds reduces the body temperature immediately, and affects the activity of the moth, which increases with its temperature. Whenever the heating of a moth is very great and rapid, it flutters its wings and so decreases its temperature (by 4·5°C. [8·1°F.] in 2½ minutes) as a result of air currents round its body. This explains why the moths fly rapidly from flower to flower on hot sunny days, remaining only a few seconds on each.

Wind, acting by convection, is a powerful factor in limiting the rise of the body temperature of both the larvae and adults ; at a velocity of 2–3 metres per second [4·5–6·7 miles per hour] it may reduce the body temperature of a moth by 10–15°C. [18–27°F.] in 2–3 minutes and bring it to the temperature of the air. In the steppe, the wind blows incessantly during the day, but in the zone close to the ground where the moth lives, its velocity is decreased by friction with soil and vegetation. Wind is also a primary factor responsible for migrations [see next paper]. The feeding of the moths increases with their body temperature, the sexually immature individuals beginning to feed at 20°C. [68°F.] and the fully developed ones at 14°C. [57·2°F.]. At a body and air temperature of 20°C. and higher, the moths feed in numbers also during the night. The maturation of the eggs is only possible when food is plentiful. Solar radiation in itself does not render the moths sterile ; but, by increasing their temperature, it intensifies metabolism and especially expenditure of water, and if sufficient food to make up for the loss is lacking, sterility results.

The fluctuations in the body temperature of the larvae depending on their food-plants and position are discussed, and the results of detailed observations are given in tables. The micro-climate formed by food-plants with large leaves, such as *Atriplex* or beet, differs greatly from that found in areas of *Artemisia*, where the larvae are always exposed to the sun. In the former case, the larvae are able to shelter under the leaves and continue feeding on their lower surface, and they feed much more rapidly than do those on *Artemisia* [*cf.* **23** 579].

Under equal conditions of feeding, the development and growth of the larvae depend on their temperature ; the duration of the life-cycle from egg to adult varies from 18 days at 30°C. [86°F.] to several months at about 15°C. [59°F.]. This explains why *L. sticticalis* has one generation a year in the northern area of its distribution in the Russian Union, three in the Kalmuik steppes, and four in Transcaucasia.

[Strel'nikov (I. D.).] **Стрельников (И. Д.). Die Wanderungen von *Loxostege sticticalis*, L.** [The Migrations of *L. sticticalis*.] [*In Russian.*]—*Bull. Inst. sci. Leshaft* **19** fasc. 1 pp. 77–120, 1 fig., 38 refs. Leningrad, 1935. (With a Summary in German.)

Systematic observations on the flight of the adults of *Loxostege sticticalis*, L., in the Kalmuik steppe and the Orenburg district in 1933 and 1934 showed that the immature moths fly up from the grass when their body temperature is about 20°C. [68°F.] or more, and the fully developed ones when it is 12·5–15°C. [54·5–59°F.]. They only do so, however, if there is little or no wind and if they are in a definite physiological condition. Once in flight, they are carried by air currents, sometimes over large distances [*cf. R.A.E.*, A **24** 816].

Local flights are due to search for food, when the newly emerged moths and immigrants concentrate on flowering vegetation, or to transport by wind, when the moths usually concentrate in tall dense vegetation in low-lying places and often on vegetables cultivated in river valleys. No indication was obtained that distant migrations are due to search for food, as the moths may leave a place where it is abundant and alight where it is scarce [but *cf.* **24** 817]. Sexual maturity of the moths is one of the factors that stimulate distant flights, and on alighting, they readily pair and oviposit, sometimes laying their eggs where there is no food for the larvae. Diurnal flights are due to solar radiation, which causes the moths to lose water, the increased molecular concentration of the body fluids exciting the nervous system. Moreover, owing to the heating of the soil, ascending air currents assist the moths in rising and carry them over considerable distances. Other factors assisting migrations are wind and lack of humidity, which increases the excitability of the nervous system in the same way as solar radiation. Positive phototropism is an important reaction, as the moths invariably rise to a certain height at dusk, when there is a sharp difference in the intensity of illumination near the ground and above it. To a less extent they rise at dawn, but the air temperature is then usually too low for the immature ones to do so. They are, however, guided by light only while in motion. In the absence of wind, they fly at the rate of about 4 ft. a second. Migrations are of a great importance in the geographical distribution of the moth ; the chief breeding foci in the Russian Union are found in the steppe and semi-desert zone, which is also the most favourable for the start of migrations.

[Lozina-Lozinskiĭ (L. K.).] **Лозина-Лозинский (Л. К.). Cold Hardiness in the Larvae of** *Loxostege sticticalis*, **L.** [*In Russian.*]—*Bull. Inst. sci. Leshaft* **19** fasc. 1 pp. 121–162, 8 graphs, 29 refs. Leningrad, 1935. (With a Summary in English.)

An account is given of laboratory investigations in Leningrad on under-cooling and cold-hardiness in larvae of *Loxostege sticticalis*, L. [*cf. R.A.E.*, A **22** 468 ; **23** 564]. The larvae were refrigerated in a medium of cryohydrates, and their temperature was measured by the thermoelectric method, the needle being carefully screwed into the anal region to avoid disturbance of the body fluids through piercing. In general, the resistance of the larvae to cold varied with the temperature at which they had been kept before exposure, their stage of development and their under-cooling capacity. Freezing, accompanied by the formation of ice crystals in the tissues, was fatal to all stages, including larvae in diapause, but the latter survived very low temperatures. While still feeding, the larvae could be under-cooled to −9°C. [15·8°F.], and individuals with empty guts or in moult were usually more resistant than others. From the cessation of feeding to the spinning of the cocoon, the larvae were very susceptible to cold and froze at temperatures above −3·1°C. [26·42°F.], but from the spinning of the cocoon until the beginning of the hystolysis that accompanies the cessation of the diapause, they could be under-cooled to −21°C. [−5·8°F.]. This may be associated with a reduction of the body water-content both by evaporation and by excretion. During the actual diapause, larvae supported temperatures as low as −25°C. [−13°F.] in some cases, although the percentage of mortality at this

temperature was 69·5 in one experiment, including some larvae in the under-cooling state. Frozen contact moisture only caused them to freeze at temperatures of about —20°C. [—4°F.]. There was a considerable reduction in cold-hardiness as soon as hystolysis set in, and larvae perished at temperatures slightly below 0°C. [32°F.], even though they were not frozen. Individuals in summer diapause at temperatures varying from 20 to 37°C. [68–98·6°F.] were as resistant to low temperatures as those in winter diapause at temperatures below 0°C. Larvae in winter diapause that were transferred to temperatures above 0°C., and then cooled, lost their undercooling capacity, easily froze and perished in consequence. Under the influence of the spring rise in temperature, the majority of the larvae pupated, with an accompanying loss of cold-hardiness, but some individuals continued in diapause and were cold-resistant. When the spring temperature fell as low as from —16 to —20°C. [3·2 to —4°F.], however, the larvae perished in large numbers, even without freezing. The rate at which refrigeration took place influenced the under-cooling and freezing points; when the fall in temperature was rapid, the freezing point was lower, but the limit of under-cooling was generally higher. Larvae in diapause were able to survive a rapid drop in temperature of 40–55°C. [72–99°F.], but repeated and rapid refrigeration to below —7°C. [19·4°F.] generally caused freezing. Larvae in diapause remained a considerable time in the undercooling state, and this condition is indispensable for hibernation, if the temperature is lower than the larval freezing point (about —5°C. [23°F.]). The water-content of the larval body cannot serve as a criterion of cold-hardiness, for, although the water-content falls when the larvae enter the cocoons, it falls further during hystolysis.

[Skoblo (I. S.).] **Скобло (И. С.). Feeding and Fecundity of** *Loxostege sticticalis* **L. Communication 1. The Effect of Feeding on Water and Sugar Syrup of different Concentrations on the Maturation of the sexual Glands and Fecundity of the Adults of the Meadow Moth (*Loxostege sticticalis* L.).** [*In Russian.*]—*Bull. Inst. sci. Leshaft* **19** fasc. 1 pp. 163–210, 2 figs., 2 graphs, 32 refs. Leningrad, 1935. **2. The Duration of the Sugar Beet Web Worm Moth's Life.** [*In Russian.*]—*T.c.* pp. 211–242, 20 refs. (With Summaries in English.)

In view of the fact that *Loxostege sticticalis*, L., has been observed to deposit a widely differing number of eggs at different times and at others to be sterile [*cf. R.A.E.*, A **21** 160; **22** 613], investigations were made in Leningrad in 1933–34 on the relation between feeding and fecundity. The results are given in the first paper. The observations were made on individuals reared and kept at 22–26°C. [71·6–78·8°F.] and 70 per cent. relative humidity. After death, all females were dissected, and their ovaries examined.

When newly-emerged females were given water but no food, the period of egg-maturation, which averaged 5·7 days, varied with the weight of the pupa from which the adult had emerged. This is dependant on larval feeding. Only 25 per cent. of females having a pupal weight of 26–30 mg. matured eggs, but this percentage rose to 77 with a pupal weight of 36–40 mg., and 84 with a pupal weight of 41–45 mg. The oviposition period, which averaged 3·6 days, ranging

from 1 to 6, and the average numbers of eggs deposited, which for females with average pupal weights of 36·1 and 46·7 mg. were 155·5 and 196, respectively, were dependent on pupal weight and determined by the amount of fat-body present on emergence.

In further experiments, newly-emerged females were fed on sugar solutions of varying concentrations on wadding, which dried up after 2–3 hours, and was not renewed till the following day. This permitted only intermittent feeding. The preoviposition period, oviposition period, number of eggs laid, and percentage of females that matured eggs averaged, for 19 individuals fed on a 5 per cent. solution, 9·8 days, 8·5 days, 146 and 212 for pupal weights of 21 and 30 mg., respectively, and 89 ; for 18 fed on a 10 per cent. solution, 11·5 days, 11·4 days, 206 for an average pupal weight of 30 mg., and 66·5 ; and for 10 fed on a 25 per cent. solution, 20·5 days, 9·25 days, 111 for an average pupal weight of 27·75 mg., and 70. Intermittent feeding thus prolonged the maturation period but had little effect on the oviposition period. This delaying effect on maturation was evident even after oviposition had begun, for whereas females given water deposited 100–120 eggs in one day, those fed on the solutions deposited batches of 10, 20 and 30 in the same time. Batches of 1–30 eggs formed only 50 per cent. of the total oviposition of females given water, but feeding on the three solutions raised this percentage to 76, 86 and 94, respectively.

In a second series of experiments on supplementary feeding, females were allowed to feed on the three solutions from pipettes, under conditions that permitted constant feeding throughout the 24 hours. Of those fed on the 5, 10 and 25 per cent. solutions, 10 out of 18, 5 out of 21, and 9 out of 26 matured eggs, the maturation periods averaging 11·3, 10·8 and 7·2 days, respectively. In all females that did not mature eggs and in some that began to oviposit, the gonads were found on dissection to be severely degenerated. Development of the yolk in the oöcytes had commenced in most cases, irrespective of pupal weight. This degeneration is attributed to over-feeding, which appears adversely to affect the functioning of the follicular cells, with the consequent under-nourishment of the oöcytes. Figures are given showing that oviposition in all females receiving supplementary nourishment is limited only by death, and that the coefficient of correlation of fecundity and pupal weight equals 80·03 per cent. The potential fecundity, based on the number of oöcytes in the gonad, of females given water and those fed on sugar solution is tabulated, whence the greater fecundity of the latter group, both ovipositing and non-ovipositing, is evident.

In an attempt to restore the fertility lost through degeneration of the gonad, eight females that had fed for 16–23 days on the 10 per cent. solution, and in which degeneration has set in, were given water only. Of these, seven matured eggs in an average of four days, three depositing an average of 186 eggs each. When dissected, they had very little fat-body left, and the gonads showed no signs of degeneration. This showed that recovery is possible when the external cause of degeneration is removed. This possibility of recovery is confirmed by observations made in 1933 on sterile females of the spring generation of *L. sticticalis* taken in nature. Of 17 females given water only, 11 eventually matured eggs, while of 25 females fed on sugar solution, 24 did so. The prolongation of the maturation period in these cases is thought to be due to the preliminary elimination of the degenerated oöcytes before healthy development can occur.

Only four of nine females given neither food nor water survived to the eighth day, and these were scarcely able to move. In this state of exhaustion, they were given 25 per cent. sugar solution on wadding, and one individual increased its weight by as much as 200 per cent. Three matured eggs (the fourth being lost) in an average of 8 days, and two deposited 315 and 374 eggs, respectively. The change in régime thus had an accelerating effect on development and fecundity.

The second paper gives the results of parallel investigations, showing that, as opposed to insects that emerge as adults with their eggs matured, those requiring a period of maturation, of which *L. sticticalis* is one, show no definite correlation between longevity and oviposition. In preliminary tests on immature females given water only, groups having pupal weights of 10–15, 16–20, 21–25, 26–30, 31–35, 36–40 and 41–45 mg. had an average adult life of 4·7, 5·2, 6·4, 7·9, 9·5, 12·3 and 14·4 days, respectively, the coefficient of correlation of these figures being 83·2±2·13 per cent. For males of these groups, excluding the first, longevity averaged 4, 5·6, 7·2, 9·5, 10·9 and 13 days, respectively. Longevity under these conditions was limited by the amount of fat-body, but was increased in moths that were given water, which lived two or three times as long as those that were not, and had no fat-body left after death. Much fat-body is used up in egg-production, and, accordingly, ovipositing females given water, having pupal weights of 30–35, 36–40 and 41–45 mg., lived for 1·3, 2·9 and 3·7 days less, respectively, than the corresponding non-ovipositing groups. No correlation was observed between the length of the egg-maturation period and that of oviposition. The latter increased with pupal weight and, for females of the above three pupal weights, was 2·25, 3·7 and 5·7 days, respectively, whereas the former remained constant at 5·5 days.

Investigations also showed that, under conditions of intermittent feeding, there is no correlation between pupal weight and longevity, as all groups, both ovipositing and non-ovipositing, lived equally long, and larval feeding had no influence. The effect on males was similar. The longevity of ovipositing females fed on 5, 10 and 25 per cent. solutions averaged 17·6, 23 and 29·5 days, respectively, but, whereas in the first group the gonads were well developed, in the last they were degenerated. When females were fed from pipettes, ovipositing individuals lived for an average of 20 days, non-ovipositing for 12. Degeneration of the sexual glands was observed on the sixth day in the laboratory, and, of 26 females, only 5 oviposited, these maturing eggs very rapidly, in an average of 7·2 days. It is thus concluded that over-feeding not only impairs oviposition but also shortens life. Three females transferred from sugar solution to water after 22 days lived for 32, 49 and 62 days in all, respectively. Of 21 females fed from pipettes on the 5 per cent. solution, 10 oviposited and lived for an average of 18·2 days, and the others, fed from wadding from the 14th day, lived for an average of 33·7 days. These latter did not mature eggs, and their gonads degenerated. The author's general conclusion on this part of the work is that the higher concentrations of sugar solution prolong the life of the moth by the amount that the preoviposition and oviposition periods are prolonged. Variations in the duration of the larval stage had no effect on the adult longevity.

[Bel'skiĭ (B. I.) & Yarmolenko (I. M.).] **Бельский (Б. И.) и Ярмоленко (И. М.). The Rationalisation of the Construction of Directional Ditches for the Control of Beet Weevils.** [*In Russian.*]—*Nauch. Zap. sakharn. Prom.* **13** no. 1 pp. 38–49, 5 figs., 9 refs. Kiev, 1936.

The chief disadvantages of the shallow ditches ploughed in beet fields in the Ukraine to trap the weevils, *Cleonus* (*Bothynoderes*) *punctiventris*, Germ., and *Tanymecus palliatus*, F., by Bezverkhiĭ's method [*cf. R.A.E.*, A **24** 487, 488] are the amount of labour necessary to clean up the edges of the ditches and the damage done to the crop by the soil that is thrown up. Experiments were therefore made in 1935 with two mechanical devices, which are described and figured, to obviate these difficulties. The first was a small wheel that was fixed below a cart at a depth that could be regulated and that left a shallow rut or ditch behind. In the experiments, ditches of various depths were made and carts with varying loads were used, but the results were unsatisfactory, owing to the irregularity of the ditch and the damage done by the horse.

Experiments were then made on the use of a raised tread round each of the rear wheels of a farm-tractor, so constructed that it left a shallow ditch. This was tested on soils of varying humidities, and a ditch about 4 in. deep, having a vertical side of about 2·5–3 ins., and 3 ins. wide was obtained. In dry soils, the edges tended to crumble a little, but in moist soil this was not the case. An advantage of this method is that the ditches may be made at the same time as the fields are cultivated in spring, when the increased humidity of the soil increases its efficiency. It is estimated that it results in a saving of 97·5 per cent. in man-power and over 75 per cent. in the cost of ditching. The comparative efficiency of ditches made in this way by compressing the soil and those made by Bezverkhiĭ's method has not yet been studied.

Experiments were also carried out on a drill of simple design for the construction of trap-pits [*cf.* **24** 488]. The drill evolved is described and figured, and was shown to make a pit in a little over half the time required by the type previously in use.

[Zakhvatkin (A.).] **Захваткин (А.). Notes systématiques sur les Acariens habitant les greniers. I–II.** [*In Russian.*]—*Bull. Soc. Nat. Moscou* Sect. biol. (N.S.) **45** no. 4 pp. 263–270, 2 refs. Moscow, 1936. (With a Summary in French.)

In 1928 Oudemans erected the genera *Ferminia* for *Glycyphagus fuscus*, Oudm., and *Blomia* for *G. tjibodas*, Oudm. In the first part of this paper the author further divides the species of *Glycyphagus*, *sens lat.*, as follows, the first species in each genus or subgenus being its type: *Glycyphagus* (*Glycyphagus*) *cadaverum*, Schr. (*privatus*, Oudm.); *G.* (*Oudemansium*, subgen. n.) *domesticus*, DeG., and *ornatus*, Kramer; *Lepidoglyphus*, gen. n., *destructor*, Schr. (*spinipes*, Koch), *pilosus*, Oudm., *fustifer*, Oudm., *geniculatus*, Vitz., *michaeli*, Oudm. (*spinipes*, Mich. *nec* Koch), and *burchanensis*, Oudm.; and *Cometacarus*, gen. n., *smirnovi*, sp. n., *setosus*, Koch, and *oudemansi*, n. n. (*setosus*, Oudm. *nec* Koch). *C. smirnovi* has recently been found in the Russian Union, but is not here described.

In the second part, the characters and systematic position of the genus *Blomia* are discussed, and descriptions are given of *Blomia kulagini*, sp. n., from stored wheat and *B. thori*, sp. n., from stored seeds of flax, both in Russia.

[Rumyantzev (P. D.).] **Румянцев (П. Д.). Biology of the Willow-moth (*Stilpnotia salicis* L.) in the Town Conditions of Moscow.** [*In Russian.*]—*Bull. Soc. Nat. Moscou* Sect. biol. (N.S.) **45** no. 4 pp. 271–278, 1 fig., 12 refs. Moscow, 1936. (With a Summary in English.)

The following is taken mainly from the author's summary of investigations on *Stilpnotia salicis*, L., in Moscow during 1931–32, when it caused serious damage to willows and poplars. The moths were active in July and laid their eggs on the leaves or occasionally on the bark or the grass at the foot of the trees. The larvae, which had 8 moults in all, fed on the leaves in autumn and entered hibernation in cracks in the bark when they were in the second or third instar and the average temperature fell to 16–18°C. [60·8–64·4°F.]. They emerged and began to feed again during the first half of May, when the average temperature was 12–13°C. [53·6–55·4°F.]. They pupated in June or July, the pupal stage lasting 10–12 days at 17–20°C. [62·6–68°F.]. The natural enemies observed included Ichneumonid and Proctotrupid parasites and the fungi, *Botrytis tenella* and *Beauveria* (*Botrytis*) *bassiana*.

[Samsoniya (K. P.).] **Самсония (К. П.). Sur la nature de l'influence des carbonates sur le charançon de grenier (*Calandra granaria* L.).** [*In Russian.*]—*Bull. Soc. Nat. Moscou* Sect. biol. (N.S.) **45** no. 4 pp. 307–311, 3 refs. Moscow, 1936. (With a Summary in French.)

The following is taken mainly from the summary. Laboratory experiments showed that *Calandra granaria*, L., and *Tenebrio molitor*, L., died as a result of feeding on grains of wheat powdered with magnesium carbonate or calcium carbonate. It was found that these salts release carbon dioxide under the influence of the acidity in the food during deglutition and that the gas dilates the mid-gut, destroys the epithelium and in this way kills the beetles. In tests with *C. granaria*, 100 per cent. mortality was caused in 10, 20 and 30 days by feeding on grain dusted with 2, 1 and 0·5 per cent. calcium carbonate by weight, respectively.

Vlach (V.). *Plodia interpunctella* **Hb. ve vlašských ořechách (Lep.).** [*P. interpunctella* infesting Walnuts.]—*Acta Soc. ent. Cechosl.* **33** no. 4 pp. 184–185. Prague, November 1936.

An instance is recorded in Czechoslovakia of a severe infestation of unshelled walnuts by *Plodia interpunctella*, Hb. The walnuts had been stored for several years, and one or more larvae or pupae occurred in each. This is the first record of *P. interpunctella* attacking nuts in their shells. When mature, the larva either emerges from the nut through a crack or pupates inside it after gnawing an exit hole for the adult.

HOFFER (A.). **K abnormálnímu výskytu** *Perotis lugubris* **Fbr. na jižni Moravě.** [An abnormal Occurrence of *P. lugubris* in southern Moravia.]—*Acta Soc. ent. Cechosl.* **33** no. 4 p. 188. Prague, November 1936.

An unusual outbreak of adults of *Perotis lugubris*, F., occurred in an orchard in southern Moravia, though this Buprestid has become rare in Czechoslovakia, following the practice of washing the stems of fruit trees with lime. The beetles attacked young apricot trees, destroying the entire bark on young branches. There was no evidence that they had emerged from these trees.

[LAZAROV (A. V.).] **Лазаровъ (A. B.).** *Oxytelus sculpturatus* **Grav., (Col. Staphylinidae), a new Insect Pest of cultivated Plants.** [*In Bulgarian.*]—[*Publ.*] *Sta. Rech. Anim. Fac. agron. for.* no. 4, 4 pp., 2 figs., 3 refs. Sofia, 1936.

Early in 1936, serious damage to seedlings of pepper, cucumber and squash in frames in a locality in north-eastern Bulgaria was caused by adults of the Staphylinid, *Oxytelus sculpturatus*, Grav., which has not previously been recorded as a pest. The adult is described, and brief notes are given on the distribution of the species and on the feeding habits of Staphylinids in general. The beetles were particularly active on sunny days, when they attempted to fly and settled in thousands on the glass of the frames. They were successfully controlled in different frames by spraying with tobacco extract, fumigating with tobacco smoke, using naphthalene as a repellent, or smearing the frames with linseed oil, which caught thousands of beetles in February 1936.

[LAZAROV (A. V.).] **Лазаровъ (A. B.). Notes on some unknown Insect Pests of the Strawberry in Bulgaria.** [*In Bulgarian*].—[*Publ.*] *Sta. Rech. Anim. Fac. agron. for.* no. 5, 4 pp., 3 refs. [Sofia, 1936.]

Insect pests recently observed on strawberries in Bulgaria include *Rhynchites aeneovirens*, Marsh., adults of which fed on the flower- and leaf-stems [*cf. R.A.E.*, A **17** 403], the Carabid, *Harpalus* (*Pseudophonus*) *rufipes*, DeG., which attacked the fruits, and an Aphid thought to be *Capitophorus potentillae*, Wlk. (*fragariae*, Theo.). The larvae of *Otiorrhynchus rugosostriatus*, Goeze, caused serious losses in the environs of Sofia in 1936, by attacking the roots of the plants, which were weakened and produced small fruits. The adults fed on the leaves, but did not do much harm. Similar injury was caused by *O. ovatus*, L., but it was much less abundant.

KEMNER (N. A.). **Två nya skadedjur inomhus,** *Tribolium destructor* **Uyttenb. och** *Sitotroga cerealella* **Oliv.** [Two new indoor Pests, *T. destructor*, Uytt., and *S. cerealella*, Ol.]—*Opusc. ent.* **1** no. 2 pp. 56–58. Lund, 1936.

Notes are given on the occurrence in Malmö of *Tribolium destructor*, Uytt. [*cf. R.A.E.*, **22** 229; **23** 524] in bird-food containing maize seed from Germany in 1934, and of *Sitotroga cerealella*, Ol., in imported maize in 1936. Neither had previously been found in Sweden. *T. destructor* is compared with the other species of *Tribolium* occurring in Scandinavia, and a key to them is given.

KANERVO (V.). **Kaalikoi** (*Plutella maculipennis* **Curt.**) **ristikukkaiskasvien tuholaisena Suomessa.** [The Diamond Back Moth (*P. maculipennis* Curt.) as a Pest of cruciferous Plants in Finland.] —*Valt. Maatalousk. Julk.* no. 86, 86 pp., 33 figs., 6 pp. refs. Helsingfors, 1936. (With a Summary in English.)

A detailed account is given of the bionomics of *Plutella maculipennis*, Curt., on crucifers in Finland, where it is a very injurious pest and has been the subject of investigation for several years [*cf. R.A.E.*, A **21** 214], and all stages are described. The eggs are usually laid on wild crucifers in early summer and on cultivated ones later; they have been found on 39 different plants, all belonging to this family, a list of which is given. Two females were observed to deposit 238 and 255 eggs, respectively, in 16–17 days at 17–20°C. [62·6–68°F.]. In investigations during 1928–29, the egg stage lasted 3–11 days at temperatures ranging from 26 to 15°C. [78·8–59°F.], and 60–90 per cent. relative humidity, the larval stage 15·5–27 days at 20·5–14·5°C. [68·9–58·1°F.] and the pupal stage 4·2–18 days at 26–12°C. [78·8–53·6°F.]. The development of the male pupae generally required 1–3 days longer than that of the female. Development from egg to adult required 25–50 days, so that three generations could develop annually during warm summers, and two and a partial third during normal ones. The actual figures for 1926, 1928 and 1929 confirmed this.

Parasites found in Finland include *Diadromus subtilicornis*, Grav., *Angitia fenestralis*, Hlmgr., *A. armillata*, Grav., and *Apanteles* spp. *A. fenestralis* is usually the commonest, but *D. subtilicornis* was the most numerous in 1928. Parasites destroyed 20 per cent. of the second-generation larvae in 1928, 70 per cent. in 1929 and 55 per cent. in 1931. Entomogenous fungi killed 50–60 per cent. of the larvae in some places in 1928. The conditions for an outbreak of *P. maculipennis* are that a preceding warm dry summer without drought, but with rainfall not heavy enough to destroy adults or larvae in large numbers [*cf.* **17** 13], should permit the development of three generations, that parasites and diseases should not have been plentiful, and that the third brood should have pupated before the frosts.

Notes on the control effected by various proprietary insecticides are given, and also an account of two laboratory experiments in which, of two lots of 50 adults, 42 and 45 were killed in 2 days by baits containing sodium fluoride, sugar and water at concentrations of 1 : 2 : 100 and 2½ : 3 : 100, respectively. Arsenical dusts were shown to be of value against the larvae in 1928 and 1931, but two applications are usually required, the second 1–2 weeks after the first.

GÄBLER (H.). *Picromerus bidens* **L. als Feind der** *Lophyrus***larven.** [*P. bidens* preying on Larvae of *Diprion*.]—*Tharandter forstl. Jb.* **88** no. 1 pp. 51–58, 9 refs. Berlin, 1937.

Nymphs of the Pentatomid, *Picromerus bidens*, L., have been observed preying on larvae of *Diprion sertifer*, Geoffr. (*Lophyrus rufus*, Retz.) on pines in Saxony. Nymphs brought into the laboratory in June became adults towards the end of July, paired early in August, and laid eggs from 26th August to the end of September. In experiments, the bugs fed on larvae of *Nematus* sp., some Diptera and several Lepidoptera, as well as on the evil-smelling larvae of *Melasoma populi*, L., but ignored larvae of *Agelastica alni*, L., adults and larvae of

Dermestes lardarius, L., and larvae of *Sarcophaga*. They also sucked the leaves of stinging nettle, poplar and *Aegopodium*, but not pine needles.

SCHWERDTFEGER (F.). **Anleitung zum Probesuchen nach Kiefernin-sekten in der Bodendecke.** [A Guide to taking Sample Counts of Pine Insects in the Ground Litter.]—Stiff paper, 20 pp., 7 pls. Berlin, P. Parey. Price, per 100, *Mk.* 1.00 each. (In Germany and Palestine *Mk.* 1.35.)

Instructions are given for collecting larvae and pupae of pine insects in the forest litter in winter for the purpose of forecasting infestation by Lepidoptera and sawflies [*cf. R.A.E.*, A **25** 126]. The stages of the principal pests and parasites found in the litter in Germany are described and illustrated.

SUBKLEW (W.). **Weitere Untersuchungen über die Bekämpfung der Drahtwürmer mit Kalisalzen.** [Further Investigations on the Control of Wireworms with Potassium Salts.]—*Ernähr. Pfl.* no. 22, repr. 3 pp., 4 refs. Berlin, 15th November 1935. [Recd. February 1937.]

Continuing previous experiments [*R.A.E.*, A **22** 249], the author tested the effect of the 0·2 per cent. solution of potassium chloride (KCl) on larvae of *Agriotes obscurus*, L., from various parts of Germany, by placing them in the solution or in sand saturated with it. The tabulated results confirm that larvae from some districts are injured and those from others are not. This physiological difference was definitely linked with the nature of the soil, larvae from soils of mixed clay and sand being susceptible and those from moorland soils resistant. That heredity was not responsible seemed proved by the fact that larvae of a strain found susceptible showed themselves resistant after being kept for a year in moorland soil.

Amtliche Pflanzenschutzbestimmungen. [Official Regulations on Plant Protection.]—*Beil. NachrBl. dtsch. PflSchDienst.* **9** no. 1 pp. 1–20. Berlin, 1st February 1937.

This part includes (pp. 11–13) regulations of December 1936 for using trap strips of beet [*R.A.E.*, A **24** 15, 17, 749] for the control of the beet leaf bug [*Piesma quadrata*, Fieb.] in Saxony. If the area of the field is less than $1\frac{1}{4}$ acres, a strip along the longest side is sufficient ; otherwise the strip must run all round the field. The exemption of certain fields and the dates of ploughing the strips and of sowing or planting different varieties of beet are subject to official decision. Spinach and mangels must not be grown at the same time as the trap strips.

CAMERON (A. E.). **The Present Status of the Douglas Fir Woolly Aphis (*Adelges cooleyi* Gillette) in Britain.**—*Forestry* **10** no. 2 pp. 133–142, 2 pls., 2 figs., 5 refs. London, 1936.

Much of this work on the life-history of *Chermes* (*Adelges*) *cooleyi*, Gill., on *Picea sitchensis* and *Pseudotsuga taxifolia* (*douglasi*) in Scotland has already been noticed [*R.A.E.*, A **24** 791]. It is further stated that the fundatrices spuriae of the first summer brood on

Pseudotsuga, which appear with the sexuparae in June [**24** 792], lay 40–60 eggs, which hatch in about 22–27 days. Most of the resulting nymphs hibernate in the first instar, but a few develop into fundatrices of the second summer brood, maturing in August, the progeny of which are entirely sistentes.

The first-stage nymphs of the first summer brood are the distributive phase on *P. taxifolia*. As well as spreading from the older needles to the new shoots, they descend the trunks to the ground (as was shown by observations of their movements over bands of white paper) and so infest new trees. It is also probable that nymphs are carried to uninfested trees on the wind. Some were found on *Picea sitchensis* and Norway spruce [*P. abies*], but these failed to develop. The mortality of this phase of *C. cooleyi* is high.

It was observed that unseasonable frosts in April, when the buds were not yet open, destroyed large numbers of the fundatrices verae on *Picea sitchensis*, and so served to favour the tree at the expense of the Aphid. Frost in May, however, destroyed many of the young buds as well as the gallicolae.

HOPF (H. S.). **Protein Digestion of Wood-boring Insects.**—*Nature* **139** no. 3511 pp. 286–287, 3 refs. London, 13th February 1937.

The author briefly discusses the results of an investigation of protein digestion in four species of wood-boring beetles, *Hylesinus fraxini*, Panz., *Lyctus* sp., *Anobium punctatum*, DeG., and *Hylotrupes bajulus*, L., including a comparative analysis of wood and frass. He concludes that the problem of excretion in wood-boring insects remains unsolved.

WATSON (M. A.). **Factors affecting the Amount of Infection obtained by Aphis Transmission of the Virus Hy. iii.**—*Philos. Trans.* (B) **226** no. 540 pp. 457–489, 9 graphs, 20 refs. London, 23rd December 1936.

The following is the author's summary. Experiments have been carried out in order to show the effect of various factors on the percentage of infection obtained with the virus Hy. iii [*cf. R.A.E.*, A **21** 2] in tobacco, using its insect vector, *Myzus persicae*, Sulz. Owing to differences in susceptibility to infection and concentration of the virus between leaves of different ages on the same plant, it is desirable to use leaves of corresponding ages for all Aphid feedings in such experiments. A maximum percentage infection was obtained during the winter months and a minimum during the summer months. The percentage infection increases with the number of Aphids used per plant, and the relation between the numbers of infections obtained for each Aphid number indicates that the infections are local and independent. The percentage infection increases with increased feeding time on the healthy plant, but there is no indication of a preliminary time period in which no infection is obtained The percentage infection decreases very rapidly with increasing time on the infected plant from 2 minutes to 1 hour. After 1 hour it increases slightly with further increase of the feeding periods. The uncertainty as to whether or not Aphids have fed on the trial leaves for the exact period allowed was overcome by either "watched feedings" or by allowing an average "penetration time" of 5 minutes. "Penetration time" was found to be increased by decreasing relative humidity in

the insectary. *M. persicae* is capable of infecting two consecutive plants without intermediate access to a source of infection, but the number of second infections decreases rapidly with increasing time on the healthy plant and is negligible after 1 hour. For some aspects of the subject, comparisons are made between Hy. iii virus and others which appear to be of the same type. Suggestions are made as to the causes of some effects and the mechanisms of infection which are involved.

Buckhurst (A. S.). **The Asparagus Fly.**—*J. Minist. Agric.* **43** no. 10 pp. 941–943, 2 pls. London, January 1937.

In 1935, *Platyparea poecilopteraa*, Schr., which had not before been recorded from England, was observed attacking asparagus in Hertfordshire. The larvae tunnel in the stems, and although the shoots for the table escape damage in England, as they are cut before infestation starts, the plants are often seriously injured by later attack on the crowns, which are progressively weakened. The life-history of the fly is briefly reviewed [*cf. R.A.E.*, A **19** 513; **22** 725]. Emergence appears to occur later in England than in other parts of Europe; in 1936 it took place from early June to mid-July. The larval stage lasts 3–4 weeks, but owing to the long period of flight of the adults, pupae and newly-hatched larvae may be found at the same time. Control measures employed in Europe are discussed [*cf.* **19** 567; **20** 57; **21** 641; **22** 431], but none of them appears likely to be satisfactory in England. Unproductive plants should be dug up in early July and burnt, and asparagus should not be planted in the vicinity for at least a year. Distorted stems should be removed and burnt early in the autumn, and should be cut as near the crown as possible, though even if this is done, many pupae will remain in the underground part of the stem and in the soil, where they can be found at any time of the year. On a small scale, promising results were obtained by the application of an emulsion of carbon bisulphide to destroy the overwintering pupae.

Morris (H. M.). **Injurious Insects of Cyprus.**—*Cyprus agric. J.* **31** pts. 1–4 pp. 9–11, 58–64, 83–93, 125–132, 10 refs. Nicosia, 1936; also as *Bull. agric. Dep. Cyprus* Ent. Ser. no. 4, 31 pp., 10 refs. Nicosia, 1937. Price 6*d.*

A list is given of some 300 injurious insects and mites in Cyprus, mainly based on records made in 1923–26 by D. S. Wilkinson and in 1927–1936 by the author and his assistants [*cf. R.A.E.*, A **16** 345, etc.]. The food-plants are shown and notes on the more important species are included. An alphabetical list of food-plants, with the insects injurious to each, is appended.

Venturi (F.). **Contributi alla conoscenza dell'Entomofauna delle Graminacee coltivate e spontanee. IV.** *Agromyza* (*Domomyza*) *mobilis* **Meigen (Diptera Agromyzidae).** [Contributions to the Insect Fauna of cultivated and wild Graminaceae. IV. *A. mobilis.*] —*Boll. Ist. Ent. Bologna* **9** pp. 1–22, 13 figs. Bologna, 15th October 1936. [Recd. February 1937.]

In this paper, which belongs to a series [*R.A.E.*, A **25** 213], detailed descriptions are given of all stages of *Agromyza mobilis*, Mg., which is

the commonest leaf miner infesting wheat in Emilia, though it has not caused any serious injury. It has one generation a year, passing the summer, autumn and winter in the pupal stage in the ground. The adults occur in March, April and May and oviposit in the leaves of wheat. The larvae hatch in 2–3 weeks, mine in the leaves for about 6 days, and then drop to the ground and pupate.

TRINCHIERI (G.). **Asserzioni gratuite. La tignola della patata e la cocciniglia di San Josè in Italia ?** [Gratuitous Assertions. The Potato Moth and the San José Scale in Italy.]—*Boll. Soc. ent. ital.* **67** no. 7 pp. 106–111. Genoa, July 1935. [Recd. February 1937.]

In view of a recent order in Jugoslavia [*R.A.E.*, A **23** 510], the author states that *Phthorimaea operculella*, Zell., and *Aonidiella* (*Aspidiotus*) *perniciosa*, Comst., do not occur in Italy.

TRINCHIERI (G.). **Il " verme rosa " del cotone in Italia.** [The Pink Cotton Bollworm in Italy.]—*Boll. Soc. ent. ital.* **68** no. 9–10 pp. 160–162, 18 refs. Genoa, December 1936.

In a recent paper [*R.A.E.*, A **24** 669], Li Feng-swen included Italy among the countries in which *Platyedra gossypiella*, Saund., occurs. The author was not aware of its presence there, but found on enquiry that it has been recorded as infesting over 50 per cent. of the cotton bolls in Sicily, where it was first observed in 1927.

CARLE (G.) & GATTEFOSSÉ (J.). **Un parasite du ver rose au Maroc.**—*Bull. Ass. Coton. colon.* no. 23, pp. 78–79, 1936, repr. in *Rev. Bot. appl.* no. 184 pp. 1001–1002. Paris, December 1936.

In 1934 and 1935, there was an obvious decrease in the numbers of *Platyedra* (*Pectinophora*) *gossypiella*, Saund., on cotton in Morocco. In 1936, the growth of the cotton was retarded by an exceptionally dry spring, and picking did not begin until November and ended in January, or even in March in some places. In January, 0·7 per cent. of the seed collected was infested with the bollworm, but 85 per cent. of the caterpillars were parasitised by *Pimpla roborator*, F., the adults of which emerged in considerable numbers in the ginning factory between 15th and 20th March. It appears that the spread of *Platyedra* in Morocco will thus be checked, as the parasite will control it if it becomes abundant and, at other times, can maintain itself on alternative hosts.

GOBEIL (A. R.). **The Biology of *Ips perturbatus* Eichhoff.**—*Canad. J. Res.* (D) **14** no. 12 pp. 181–204, 1 pl., 4 figs., 27 refs. Ottawa, December 1936.

A detailed account is given of the biology of *Ips perturbatus*, Eichh., on white spruce [*Picea glauca*] in the Gaspé Peninsula from observations made during the summers of 1933 and 1934. The following is substantially the author's summary : This species generally breeds on trees killed by *Dendroctonus piceaperda*, Hopk., but was also found on white spruce dying from the attacks of *Diprion polytomus*, Htg. In the Gaspé peninsula, there is one complete generation a year.

At the end of September and the beginning of October, the young adults leave the tree to hibernate in the ground. Emergence from the ground occurs in the spring. Experiments show that the adult stage lasts nearly two years. During their first complete summer as adults, the females lay two sets of eggs. They lay a third set in the following spring and die during the summer. There are 1–4 egg tunnels per engraving. The average number of eggs per egg tunnel decreases with the increase in the number of females per engraving. Dissection of 500 beetles indicates that the two sexes are present in about equal proportions. Analysis of the results of a population study made on a white spruce representing 48 sq. ft. of tree surface attacked by *I. perturbatus* showed 2,448 egg tunnels, 22,512 young beetles, 58,800 egg niches, and a mortality rate of 58·33 per cent.

Coeloides dendroctoni, Cushm., is the most important parasite of this Scolytid, but does not kill more than 5 per cent. of the larvae and pupae. No trace of woodpecker control was noticed.

Service and Regulatory Announcements, July–September 1936.—*S.R.A., B.E.P.Q.* no. 128 pp. 95–150. Washington, D.C., U.S. Dep. Agric., December 1936.

This number includes summaries of the plant quarantines and other restrictive orders and miscellaneous regulations at present in force in the United States, Hawaii and Porto Rico (pp. 144–150), of the plant quarantine restrictions of Malta, Denmark, the Irish Free State, Danzig, Mexico and Switzerland (pp. 115–141), and of new regulations in Chile, Argentina, Palestine and Brazil (pp. 112–115).

Farrar (M. D.). **The Effect of Petroleum-oil Sprays on Insects and Plants.**—*Illinois nat. Hist. Surv. Bull.* **21** art. 1 pp. 1–32, 21 figs., 3 pp. refs. Urbana, Ill., November 1936.

This discussion of the effect of petroleum-oil sprays on insects and plants is based partly on the literature but mainly on investigations carried out in Illinois in 1925–33. It is concluded that the injury caused to the plants is largely determined by the ratio between saturated and unsaturated hydrocarbons in the oil, although emulsions made with soap are generally toxic to foliage irrespective of the saturation or viscosity of the petroleum oil employed. Oils with a viscosity of 50 seconds Saybolt or less are less toxic to plants than heavier ones but are not effective insecticides, and those with a viscosity greater than 100 seconds tend to create physiological disturbances within the growing plant. The amount of emulsifier determines to some extent the physical nature of the emulsion and its insecticidal value. The emulsions containing larger droplets of oil are more toxic to insects and less toxic to plants. However, experiments in the laboratory on the effect of different emulsions on the larvae of the codling moth, *Cydia* (*Carpocapsa*) *pomonella*, L., show that the possibility of increasing the mortality by changes in the physical properties of the emulsion is limited.

White oil emulsions alone are not equivalent to lead arsenate in sprays against the larvae of *C. pomonella* on apple, but when combined with nicotine sulphate they are comparable to lead arsenate in the control of the late brood. The value of the spray as a contact insecticide was increased by the addition of extracts of pyrethrum, derris or tobacco,

but of these only nicotine was stable to exposure under conditions in the field. The most favourable mixture contained 1 per cent. summer oil emulsion with nicotine sulphate at dilutions of 1 : 800 to 1 : 1,600. White oil emulsions can be used as ovicides in codling moth control either alone or in the lead arsenate sprays. The best control of *Tetranychus* sp. on conifers was given by a spray containing oil (viscosity 83 seconds) emulsified with gum. The concentration of miscible oil required in sprays against *Aonidiella* (*Aspidiotus*) *perniciosa*, Comst., depends on the properties of the emulsion, the most effective ones containing relatively large oil droplets associated with high wetting and quick breaking properties. The best results were given by an oil of 83 seconds viscosity emulsified with soap at a dilution of 2·5 per cent. The same emulsion at a dilution of 0·5 per cent. gave good results against Aphids, the control of which depends on the high wetting power and low stability of the spray, or on the presence of limited quantities of nicotine. Laboratory tests on Aphids with a spray containing 2 per cent. stock emulsion and free nicotine show that the mortality is higher when $\frac{1}{4}$ per cent. soap is added to increase wetting than when the emulsion contains twice the amount of nicotine without soap. *Lepidosaphes ulmi*, L., was controlled with a 2 per cent. emulsion of white oil applied about the time that the young scales hatched. Almost any oil that does not injure foliage will give control of this Coccid when applied at 2 per cent. concentration. A miscible oil at a concentration of 4 per cent. was effective against *Gossyparia spuria*, Mod., on elm when applied as a delayed dormant spray, but the wide dispersal of the young over the leaves makes their control by summer sprays more difficult. Tests in the laboratory showed that the less stable emulsions are the more effective against the eggs of *Tortrix* (*Archips*) *argyrospila*, Wlk. (fruit-tree leafroller) ; emulsions with large oil droplets, such as occur in cold-mixed emulsions, are better than commercially prepared emulsions when compared at equal concentrations. Dormant oil emulsions can be used with fungicides containing sulphur in the dormant stage of tree development, but it is doubtful whether fungicides of the more common types can be used with summer emulsions without decreasing the effectiveness of the spray or injuring the foliage.

Fulton (R. A.) & Mason (H. C.). **The Adsorption-absorption and Translocation of Derris Constituents in Bean Plants.**—*Science* **85** no. 2202 p. 264. New York, 12th March 1937.

Observations in field work in which derris and cubé [*Lonchocarpus*] were used as insecticides showed the possibility of the constituents of these roots being adsorbed-absorbed by the plants and translocated to new growth. Two varieties of beans grown in pots in greenhouse conditions were treated, before the first trifoliate leaves appeared, with suspensions of derris in water containing 0·025, 0·05 and 0·25 per cent. rotenone. Some of the plants were treated by spraying the entire plant, some by painting only the first pair of true leaves, and some by painting only the stems. As soon after treatment as the first trifoliate leaves had attained a fair size, larvae of *Epilachna varivestis*, Muls., were fed on them, and the leaf areas consumed were measured. There was very low mortality among the larvae fed on the new growth from either treated or untreated plants, but there was a definite reduction in feeding area of new growth on treated plants as

compared with untreated ones. Chloroform extracts prepared from the same plants tested on goldfish in water suspension killed them all, but no mortality occurred with extracts from untreated plants.

Fife (J. M.) & Frampton (V. L.). **The pH Gradient extending from the Phloem into the Parenchyma of the Sugar Beet and its Relation to the feeding Behavior of** *Eutettix tenellus*.—*J. agric. Res.* **53** no. 8 pp. 581–593, 4 figs., 13 refs. Washington, D.C., 15th October 1936.

In seedlings of sugar beet exposed to a high concentration of carbon dioxide, the pH gradient in the petiole, which usually rises gradually from the epidermis to the phloem, was entirely upset and even reversed. Experiments with artificial food proved that *Eutettix tenellus*, Baker, which transmits curly top, and the saliva of which is alkaline in reaction, prefers an alkaline (pH 8·5) to an acid (pH 5·0) food. Its mouth-parts are directed to the alkaline phloem by the pH gradient. When, by means of a specially constructed apparatus, the leafhoppers were allowed to feed for half an hour on beet seedlings that were under the influence of carbon dioxide, only 12·12 per cent. of the trails terminated in the phloem as against 55·79 per cent. of the trails in normal plants [*cf. R.A.E.*, A **22** 525], and in no instance had the leafhopper changed the direction of its mouth-parts to reach the phloem, whereas this occurred in 7·37 per cent. of the trails in normal petioles. The proportion of curly top in normal and treated seedlings was 4·7 : 1 and corresponded closely to the proportion of trails reaching the phloem. This is further evidence that the disease can be transmitted only by inoculation of the virus into the phloem [*loc. cit.*].

Mikulski (J. S.). **The Effect of constant and alternating Temperatures on the Survival of some developmental Stages of** *Tribolium confusum* **Duv. (Col.).**—*Bull. int. Acad. polon.* 1936 B II no. 5–7 pp. 361–372, 3 graphs, 32 refs. Cracow, 1936. **On the Changes of developmental Velocity of some developmental Stages of** *Tribolium confusum* **Duv. (Col.) when influenced by constant and alternating Temperatures.**—*T.c.* pp. 373–385, 2 graphs, 33 refs.

In the first paper, an account is given of experiments in 1934–35 in Illinois to determine the action of different constant and alternating temperatures on the eggs and pupae of *Tribolium confusum*, Duv. The insects were bred in stable conditions at a temperature of 25°C. [77°F.]. The material subjected alternately to two temperatures remained in each for 12 hours. The cycle of the experiments was divided into six series, corresponding to mean constant temperatures of 32·5°C. [90·5°F.], 30°C. [86°F.], 27·5°C. [81·5°F], 25°C., 22·5°C. [72·5°F.] and 20°C. [68°F.]. In each of these series, from one to four combinations of alternating temperatures were employed in which the amplitudes of fluctuation were 5, 10, 15 and 20°C. [9, 18, 27 and 36°F.].

The effect of constant temperature differed from that of alternating temperatures for both eggs and pupae. There was a narrow favourable thermal range, which differed for eggs and pupae. At constant temperatures, 50 per cent. of the eggs survived at from over 25 to 30°C., and 50 per cent. of the pupae from below 25 to 30°C. The upper limit

for the eggs was 32·5°C., at which practically none survived, though 80 per cent. of the pupae did so. The most favourable constant temperature was 30°C., at which survival in both stages amounted to practically 100 per cent. The range of survival of both eggs and pupae was wider at alternating than at constant temperatures, though the maximum was about 88 per cent., never 100. At the alternating temperatures, the percentage of survival was smaller at about 27·5°C., and greater at 20–27·5°C. than it was at the constant temperatures. Natural conditions are more similar to alternating than to constant temperatures, and it is probable that in the most favourable circumstances in nature survival can reach 100 per cent.

The experiments described in the second paper, which were made by the same technique, showed that constant and alternating temperatures act differently on the rate of development of eggs and pupae of *Tribolium confusum*, Duv. It was established that delay in development can be of advantage to the insect, that the action of constant temperatures has only a theoretic value as regards the problem of the effect of temperatures on development, and that such investigations cannot explain phenological phenomena.

Haydak (M. H.). **Is Wax a necessary Constituent of the Diet of Wax Moth Larvae?**—*Ann. ent. Soc. Amer.* **29** no. 4 pp. 581–588, 15 refs. Columbus, Ohio, December 1936.

An account is given of experiments in which two generations of the larvae of the wax moth, *Galleria mellonella*, L., were reared to the adult stage on a number of media that did not contain wax, and the constituents required for an adequate food are discussed.

Bess (H. A.). **The Biology of *Leschenaultia exul* Townsend, a Tachinid Parasite of *Malacosoma americana* Fabricius and *Malacosoma disstria* Hübner.**—*Ann. ent. Soc. Amer.* **29** no. 4 pp. 593–613, 24 figs., 19 refs. Columbus, Ohio, December 1936.

The Tachinid described by Townsend as *Blepharipeza exul* has been considered by various workers to be a synonym of *B. adusta*, Lw., but Townsend and Aldrich now agree that *Blepharipeza* is synonymous with *Leschenaultia*, and characters distinguishing the two species are here reproduced from an unpublished key prepared by R. T. Webber. *L. exul* is a common parasite of the larvae of *Malacosoma americana*, F., and *M. disstria*, Hb., in the north-eastern United States. All its stages are described in detail, and an account is given of studies on its life-history, in which the host used was *M. americana*. The following is based on the author's summary: The species has only one generation a year in the New England States, overwintering in the pupal stage. The adults emerge in late April and early May, and oviposit on the foliage of trees on which the host larvae feed. Eggs may remain viable for a period of 26 days after deposition, and a single female may lay as many as 5,000. The eggs are ingested by host larvae feeding on the foliage. They hatch within the alimentary tract, and the larvae migrate to the salivary glands of the host, where they pass the first instar. The second instar begins just before or just after migration from the salivary glands, and in this instar an integumental funnel is developed in which the larva completes its development. The mature third-instar larva leaves the host larva or pupa to pupate in the soil.

Larval development is completed in about 13 days, and pupation has usually occurred by 1st July. In most cases, only one mature larva issues from one host larva or pupa.

Leschenaultia exul apparently competes with several species of Dipterous and Hymenopterous parasites. An experiment with a small number of larvae of *M. americana* indicated that *Compsilura concinnata*, Mg., is successful more often than not when competing with *L. exul*, if the host is parasitised by both at about the same date.

Jacot (A. P.). **Three possible Mite Vectors of the Dutch Elm Disease.**—*Ann. ent. Soc. Amer.* **29** no. 4 pp. 627–635, 13 figs., 8 refs. Columbus, Ohio, December 1936.

Descriptions are given of *Monieziella arborea*, sp. n., *Histiogaster fungivorax*, sp. n., and *Mégninietta ulmi*, gen. et sp. n., which were taken on elm in New York State, either in cracks in the bark or in the galleries of Coleoptera in association with frass. The first two species were associated with *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., and *Histiogaster fungivorax*, which was the most abundant, was also found in egg tunnels of *Scolytus multistriatus*, Marsh., that were infested with coremia of *Ceratostomella ulmi*. It is considered possible that the mites distribute the spores of *C. ulmi* when, in the hypopial stage, they are transported by other Arthropods to uninfected trees [*cf. R.A.E.*, A **22** 649].

Davis (J. J.). **Insects of Indiana for 1935.**—*Proc. Ind. Acad. Sci.* **45** pp. 257–268, 2 figs. Indianapolis, Ind., 1936.

In this paper, which is one of a series [*cf. R.A.E.*, A **23** 730], the weather conditions of 1935 in Indiana are compared with those of 1934, and notes are given on their effect on some of the numerous insect pests recorded. The shattering of much grain owing to the hot, dry summer of 1934, the sowing of wheat before the recommended date, its early sprouting and the maximum emergence of adults on account of the wet autumn resulted in the occurrence of very large numbers of overwintering puparia of *Mayetiola* (*Phytophaga*) *destructor*, Say. This led to unprecedented numbers of flies in spring, which were sufficient to cause heavy infestation of wheat regardless of the date on which it had been sown in autumn. In spite of heavy rain in the autumn of 1934, *Blissus leucopterus*, Say, hibernated in great numbers in the northern two-thirds of the State. The white mould fungus disease, however, caused high winter mortality and was favoured by frequent rains in spring and early summer, which also caused high mortality by their mechanical action and prevented migration by occasioning an excessive growth of grass in the grain stubble, so that serious damage was not general. Other pests of cereal crops included *Cirphis unipuncta*, Haw., large numbers of which attacked wheat in June following an abundance of adults in April and May, and *Pyrausta nubilalis*, Hb., which, under favourable conditions, increased its numbers on maize, making up much of the ground it had lost during the exceptionally unfavourable weather of 1934. Early pupation of overwintered larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., on apple was stimulated by abnormally high temperature in March, but the cold weather of April–June, accompanied by high rainfall in May and June, checked the development of the first brood.

Back (E. A.) & Cotton (R. T.). **The Furniture Carpet Beetle (*Anthrenus vorax* Waterhouse), a Pest of increasing Importance in the United States.**—*Proc. ent. Soc. Wash.* **38** no. 9 pp. 189–198, 2 figs., 16 refs. Washington, D.C., January 1937.

Notes are given on the bionomics and distribution in the United States of a carpet beetle referred to in previous papers [*R.A.E.*, A **11** 519; **14** 249; **16** 202] as *Anthrenus fasciatus*, Hbst., but later identified as *A. vorax*, Waterh., and discussed under that name, which was, however, erroneously attributed to Casey [**19** 95, 217, etc.]. It has become the most destructive household pest in the District of Columbia and has been reported from most of the States on the east coast. It feeds on anything containing such animal substances as wool, hair, feathers, horn, and silk, and although it does not normally attack fabrics made of vegetable thread, it will do so if these are near favoured foods or are stained with animal excreta. Larvae have also been found in houses feeding on dead mice, insects, dried cheese, glue in bookbindings, etc. Females begin to oviposit 1–3 days after emergence, and 15 of them confined with males in glass tubes containing fabric laid 37–96 eggs in batches. The eggs hatch in 10–15 days in summer, but die if exposed to cold. The larvae moult at least 6–11 times. The pupal stage lasts 9–13 days in summer and adults may live several months, although ovipositing females usually die within a fortnight. The life-cycle is completed in about a year, but some individuals appear to require two years, so that the destructive larval period is long.

Barber (H. S.). **Some Species of *Colaspis* from the *brunnea* Confusion (Coleoptera : Chrysomelidae).**—*Proc. ent. Soc. Wash.* **38** no. 9 pp. 198–204, 16 refs. Washington, D.C., January 1937.

The author points out that several North American species of *Colaspis* have been confused under the name *C. brunnea*, F. They have not yet been studied satisfactorily, but they include *C. pini*, sp. n., and *C. pini* subsp. *schotti*, n., here described from pines in Louisiana and Mississippi and in New Jersey, respectively. In this connection, he also discusses the confusion that has arisen between the American *C. brunnea* and the New Zealand "bronzed beetle," *Eucolaspis brunnea*, F., which was for many years included in *Colaspis*. He points out that the American species was erroneously referred to *Eucolaspis* in volumes **12** and **15** of this *Review* and states that this usage has been continued up to the volume for 1936.*

Buchanan (L. L.). **Nomenclature of *Listroderes obliquus* Klug (the Vegetable Weevil) (Coleoptera : Curculionidae).**—*Proc. ent. Soc. Wash.* **38** no. 9 pp. 204–208, 3 pp. refs. Washington, D.C., January 1937.

The author discusses the identity of the insect commonly known as the brown vegetable weevil, which has become established in various countries and is considered by some authors to be *Listroderes costirostris*, Schönh. 1826 (*obliquus*, Gylh. 1834) [*cf. R.A.E.*, A **21** 432]. He considers that on biological grounds it may be distinct from

* This latter statement requires qualification, as the error was corrected in the Errata and Index of vol. **21** and has not been repeated in vols. **23** and **24**, the only subsequent ones in which the American species is mentioned.

L. costirostris, but that, if this is so, its correct name is *L. obliquus*, Klug 1829. All these three forms were described from Brazil. His chief reason is the allusion to a male in Schönherr's original description and the fact that the brown vegetable weevil is apparently parthenogenetic, as no male of it has been recorded in the literature or found by him among 1,186 specimens from Mississippi.

THOMAS (C. A.). **The Tomato Pin Worm** (*Gnorimoschema lycopersicella*, **Busck**).—*Bull. Pa agric. Exp. Sta.* no. 337, 15 pp., 2 pls., 28 refs. State College, Pa, August 1936. [Recd. 1937.]

An account is given of the bionomics and control of *Phthorimaea* (*Gnorimoschema*) *lycopersicella*, Busck, infesting tomatos in greenhouses in Pennsylvania and Delaware [*R.A.E.*, A **24** 525], and all stages are described. It is apparently unable to survive the winter out of doors in Pennsylvania. In experiments in which infested leaves were kept in the open from early November 1935, those brought indoors in January 1936 produced many live active moths within two weeks, but no living stages were obtained from those brought indoors on 1st March, after some weeks of very severe weather.

HAWLEY (I. M.) & HALLOCK (H. C.). **Life History and Control of the Asiatic Garden Beetle.**—*Circ. U.S. Dep. Agric.* no. 246 (revd), 20 pp., 13 figs., 3 refs. Washington, D.C., October 1936.

This circular is a revision of a previous one [*R.A.E.*, A **21** 456] on the bionomics and control of *Aserica castanea*, Arrow (Asiatic garden beetle) in the United States, and some of the additional information in it has already been noticed [**24** 529]. A description is given of a light-trap for general use on small properties where there are no lights in competition. It consists of a funnel and above it a baffle with four wings [*cf.* **19** 354], in the cut-out centre of which is a 100-watt daylight lamp. A jar is attached to the lower end of the funnel to catch the beetles. The baffle and inside of the funnel are painted white, and the outside of the funnel green. The trap is suspended from a metal standard. As many as 2,000 beetles per hour have been caught in such a trap. Another trap for use in brightly lighted places has the same general structure but is larger, and the cut-out area admits a G-5 mercury vapour lamp, which emits a bluish light particularly attractive to the beetles. As many as 4,700 beetles have been caught in this trap per hour.

WAIKDEN (H. H.). **Life-history Notes on the Spotted-sided Cutworm** (*Agrotis badinodis* **Grote**).—*J. Kans. ent. Soc.* **10** no. 1 pp. 20–26, 1 fig., 4 refs. McPherson, Kans., January 1937.

An account is given of observations in Kansas on the bionomics of *Agrotis badinodis*, Grote (spotted-sided cutworm), which is considered a potential pest of cereals and forage crops in the centre and east of the United States, though no outbreak of it is known to have occurred. The food-plants recorded in the literature include clover, tobacco and various weeds, and larvae were taken by the author on clumps of self-sown wheat and on the tender leaves of lucerne. Only one generation occurs during the year, the adults emerging in early October.

In the laboratory, the egg, larval, prepupal and pupal stages lasted 14–15, 169–188, 3–14, and 119–170 days, respectively. The larvae were fed on lucerne and had 7 instars; the average widths of the head capsule of the first 6 are given. Larvae placed in an outdoor cave were inactive from early December to mid-February owing to the cold. They resumed feeding in late February, and by late April had entered the soil to pupate.

Only a few larvae were found in the field, but 4 out of 38 were parasitised and 2 were killed by a fungus.

EMERY (W. T.). **Hessian Fly Eggs and Freezing Temperatures.**—*J. Kans. ent. Soc.* **10** no. 1 pp. 28–29, 1 ref. MacPherson, Kans., January 1937.

Eggs of the Hessian fly [*Mayetiola destructor*, Say] on blades of wheat were exposed to winter temperatures in Kansas for periods of 10–31 days. After 17 days, 11 of which had temperatures below freezing, only 28 per cent. of 150 eggs hatched, but after 24 days, 17 of which had temperatures below freezing, 86 per cent. of 145 eggs hatched. After 31 days, when 97 eggs had been exposed for 200 hours to freezing temperatures, 18 of which were below 20°F., with a minimum of 11°F., 44 per cent. hatched. It is possible that the high relative humidity maintained in the containers by the use of wet cotton stoppers was a factor in enabling the eggs to withstand the low temperatures.

HASEMAN (L.) & others. **Entomology.**—*Bull. Missouri agric. Exp. Sta.* no. 370 (Rep. 1934–35) pp. 51–55. Columbia, Mo., November 1936.

Biological studies on the codling moth [*Cydia pomonella*, L.] on apple in Missouri in 1935 showed that there were two complete broods and a partial third [*cf. R.A.E.*, A **24** 318]. Growers generally secured better control, the crops showing about 70–80 per cent. sound fruit as compared with 25–50 per cent. during the previous two years. Temperatures of approximately 85°F. are the optimum for the moth and its development practically stopped at 50 or 110–115°F. The heavy rains in the spring retarded activity, but were not the determining factor in better control, as about 75 per cent. of the fruit in unsprayed control plots was lost, and 50 per cent. of the picked fruit was infested. From 3 to 10 cover sprays, in addition to a calyx spray, were used in the experiments, the larger number being applied at 7–10 day intervals in the older orchards with heavy infestations. Most of the plots where the sprays were timed by moth emergence received 2–3 sprays less. In tests with substitutes for arsenicals, the best results were obtained with nicotine. It was used with lead arsenate in two applications and later alone at a dilution of 1 in 200. It gave almost the same control as when lead arsenate was used in all the applications, and a similar degree of control was obtained when natural cryolite was used for the late applications. Of arsenicals not containing lead, zinc arsenate seemed the most promising, and calcium arsenate also gave good results. A mixture of 1 lb. lead arsenate and ½ lb. Paris green in 100 U.S. gals. spray was approximately equivalent in toxicity to 2–3 lb. lead arsenate. With the latter, the use of summer oil emulsion and other spreaders in the so-called peak sprays slightly improved control but increased the difficulty of residue

removal. Rotenone and some other chemicals were far more toxic to the larvae than lead arsenate under laboratory conditions, but did not prove effective or safe in the orchard. Reduction of the size of the arsenical particles by regrinding increased adhesiveness and toxicity. Experiments with varying numbers of bait traps for the moths did not seem to justify their use for control. The parasite, *Ascogaster carpocapsae*, Vier., was released in limited numbers, but no definite indication of its value has been obtained. The native parasite, *Aenoplex carpocapsae*, Cushm., is increasing in some localities, where 5–10 per cent. of the larvae collected in the autumn were parasitised.

Winter burning of clump grass in which the chinch bug [*Blissus leucopterus*, Say] shelters killed only 10–20 per cent., and although the air temperature soon afterwards fell below 0°F. the total mortality rate was only 25–40 per cent. [*cf.* **24** 318; **25** 167]. The Hessian fly [*Mayetiola destructor*, Say] increased in numbers during the year. Tests of 7 varieties of wheat showed that all were about equally attractive to the flies for oviposition, but that the larvae failed to mature on some, the percentage infestation ranging from 3 to 66.

ALVARADO (J. A.). **Minador de la hoja del Carreto.** [A Leaf-miner of *Prunus*.]—*Rev. agríc.* **14** no. 4 pp. 222–226, 1 pl. Guatemala, 1936.

All stages are described of a species of *Leucoptera* mining the leaves of *Prunus* in Guatemala and distinct from *L. coffeella*, Guér., which attacks coffee and other plants and is the most destructive leaf-miner in the country.

ALVARADO (J. A.). **Plaga de gusanos del pino en San Juan del Obispo.** [An Outbreak of Larvae on Pines in San Juan del Obispo, Guatemala.]—*Rev. agríc.* **14** no. 4 pp. 229–233, 4 figs. Guatemala 1936.

Pines in the district of San Juan del Obispo, Guatemala, were defoliated in the autumn of 1936, apparently by sawfly larvae. No injury was done to other plants, and as pines recover from such temporary defoliation and are of little value in the district, control is not considered advisable.

SWEZEY (O. H.). **A preliminary Report on an Entomological Survey of Guam.**—*Hawaii. Plant. Rec.* **40** no. 4 pp. 307–314. Honolulu, 1936.

The author carried out a survey of Guam in 1936 and here records some 50 species of insects attacking the various crops grown there. A separate list shows those that do not occur in Hawaii.

NOBLE (N. S.). *Euplectrus agaristae* **Crawford, a Parasite of the Grape Vine Moth**—*Phalaenoides glycinae* **Lew.**—*J. Aust. Inst. agric. Sci.* **2** no. 4 pp. 165–168, 2 figs., 1 ref. Sydney, December 1936.

The Eulophid, *Euplectrus agaristae*, Crwf., is a gregarious ectoparasite of the Agaristid, *Phalaenoides glycinae*, Lewin, which is a common vine pest in New South Wales. It was unusually abundant in 1935, and several generations were bred in cages in which the host larvae were

kept on small potted grape-vines. The female usually oviposits on larvae in the fourth or fifth instar, but those in the sixth or last instar are sometimes successfully parasitised and yield large numbers of adults. The integument of the larva is pierced on the dorsal surface and the egg deposited on the site of the puncture. Several are laid in a small group, slightly separated from one another ; as many as 31 may be deposited in 10 minutes. On hatching, the larva feeds externally on the host, remaining in one position till fully fed. As the larvae grow, they soon form one compact mass. During the earlier stages, the host continues to crawl about the vines, feeding in a normal manner, but as the parasite larvae increase in size, it becomes sluggish, and dies just before or after the parasites are full-grown. These, on maturing, release their hold and pass to the lower surface of the host, where each secretes from the anus a gelatinous fluid (produced by highly modified Malpighian tubes), which dries to form coarse fibres. By means of these the parasites attach the dead host to the leaf surface, and eventually enclose themselves in crude cocoons in which they pupate. All the adults from any one group of cocoons usually emerge within a few hours, the males appearing first and fertilising the females as they emerge. Of 367 adults bred under laboratory conditions, 87·19 per cent. were females. The total number of adults from any one host ranged from 2 to 60, with averages of 17·82 from parasitised host larvae collected in the field, and 31·63 from those bred in the laboratory. In the laboratory, oviposition was sometimes excessive, as many as 172 eggs being deposited on one larva. In such cases, all the eggs hatched and the larvae reached a similar stage of development ; if sufficiently advanced at the time the food supply was exhausted, they all developed into miniature adults, in other cases all died of starvation.

Under laboratory conditions, the incubation, larval, prepupal and pupal periods averaged 3·1, 4·24, 2·26 and 7·58 days, respectively. The average length of life of 271 adults was 49·78 days ; no male lived for more than 69 days, but a number of fertilised females that emerged in February survived for just over 6 months until the following spring.

EVANS (J. W.). **The Overwintering of the Larvae of *Tortrix postvittana* Walk. in Apple Orchards.**—*J. Aust. Inst. agric. Sci.* **2** no. 4 pp. 169–170, 2 refs. Sydney, December 1936.

Experiments on *Tortrix postvittana*, Wlk., attacking apples in Tasmania, showed that larvae in the first three instars feed on leaves treated with lead arsenate and succumb immediately, but that more mature larvae will not attack such leaves and die of starvation if unsprayed foliage is not available. It has been suggested that infestation of apple is due to moths migrating each year from adjoining evergreens, etc. [*cf. R.A.E.*, A **22** 477] ; but orchards are sometimes so severely attacked that it seems certain that the population in them has been built up for several years, and evidence has recently been obtained to show that the larvae can overwinter in the orchard. There are 2 generations annually, the larvae of the first occurring from November to February, when many succumb to lead arsenate sprays applied against the codling moth [*Cydia pomonella*, L.]. The survivors gave rise to adults that oviposit on apple leaves, and many of the larvae of the second generation, owing to the absence of late cover sprays, are able to feed with impunity until the leaves fall.

Some then feed on such weeds as are available in the orchard, and it has been found that, although no true hibernation takes place, larvae that have reached the third instar can live for as long as 2½ months during the winter without feeding. An examination of flower-bud clusters on trees in infested orchards in October 1935 resulted in the discovery of larvae on every tree investigated, although an oil spray had been applied some weeks previously. It thus appeared that the larvae had overwintered on the orchard floor and climbed the trees in the first warm weather. This was confirmed by banding experiments in October 1936, when 1–7 larvae per tree were caught in nearly every case. *T. postvittana* is now seldom of economic importance on the mainland of Australia owing to the late cover sprays of lead arsenate applied against *C. pomonella*; in Tasmania, the latter has only one complete generation a year, and spraying against it is discontinued early.

WESTERN AUSTRALIA. **Annual Report of the Department of Agriculture for the Year ended 30th June 1936.**—32 pp. Perth [W. A.], 1936.

In the course of this report (pp. 27–28), information additional to that already noticed [*R.A.E.*, A **24** 134, 445; **25** 164] is given on the work on insect pests carried out in Western Australia during the year ending June 1936. A serious outbreak of *Austroicetes jungi*, Branc., occurred over a wide area in the South-West Division and the south of the North-West Division. This grasshopper appears to be spreading slowly throughout the regions of lighter rainfall. It is indigenous in these districts, but the large numbers of breeding grounds produced by clearing the land of trees without putting down grass or crops has led to a large increase in its abundance. The Government contributed £1,000 for poison bait, but although millions of grasshoppers were destroyed, the remaining ones laid sufficient eggs to reinfest the districts to a serious extent in the following spring. Tests showed that a large percentage of the eggs would hatch under suitable conditions. The only parasite found was a Bombyliid larva that fed on the eggs, but it did not give control. In the north of the State, the orange-piercing moth, *Othreis* (*Argadesa*) *materna*, L., attacked cultivated fruits, particularly *Citrus*, to an extent not previously recorded, as native ones were prevented from forming by the drought. A series of tests showed that *Bruchus pisorum*, L. can be destroyed by fumigating seed peas for 48 hours with carbon bisulphide at the rate of 4 lb. per 1,000 cu. ft.

MORGAN (W. L.) & HELY (P. C.). **Tomato Fruit Caterpillar. Control Experiments with late Autumn Crops.**—*Agric. Gaz. N.S.W.* **47** pt. 12 pp. 691–693, 1 fig. Sydney, December 1936.

Experiments with sprays and dusts against *Heliothis armigera*, Hb. (*obsoleta*, F.) and *Phthorimaea operculella*, Zell., attacking the fruit of tomatos in New South Wales were carried out on plots of 20 plants with buffer areas between them. The crop was treated weekly from 13th March to 29th May, and the fruit picked weekly from 8th April

to 3rd June and examined for infestation. The sprays were applied in 1 : 1 : 10 Bordeaux mixture, and the plants to receive dust treatments were sprayed with Bordeaux before each application. The average percentages of fruits infested by *Heliothis* and *Phthorimaea*, respectively, were : 9·4 and 3·4 for 1 lb. lead arsenate in 40 gals. spray ; 5·0 and 3·3 for 1½ lb. lead arsenate in 40 gals. ; 6·0 and 1·4 for 1½ lb. lead arsenate and ½ lb. casein-lime (1 : 4) in 40 gals. ; 5·5 and 4·0 for a dust of lead arsenate and kaolin (1 : 4) ; 6·3 and 4·8 for calcium arsenate and kaolin (1 : 4) ; 18·0 and 8·3 for 1 pint nicotine sulphate, 8 lb. bentonite sulphur and 1¼ lb. casein-lime (1 : 4) in 100 gals. spray ; and 11·4 and 4·5 for 1 pint nicotine sulphate and 1 gal. white oil emulsion in 100 gals. spray. The nicotine sulphate sprays controlled Aphids, which developed rapidly in the plots undergoing the other treatments, especially those being dusted. Fruit russeting and a general hardening of the plant was thought to be due to the frequent applications of Bordeaux. Calcium arsenate dust scorched the foliage, and nicotine sulphate with bentonite sulphur caused some scorching of foliage and russeting of fruit. Nicotine sulphate and oil delayed ripening and caused the development of small corky areas on the fruit. When plants heavily infested with Aphids were sprayed with nicotine sulphate (1 : 800) in a lead arsenate-Bordeaux spray, injury to the flowers and young leaves resulted. Subsequent tests showed that Bordeaux alone and Bordeaux with nicotine sulphate, 1 in 800 and 1 in 1,600, caused similar injury, but this did not occur when 1 per cent. white oil emulsion was added to nicotine sulphate and Bordeaux (1 : 1,600).

Wilson (L. J.). **Removal of Spray Residues from Tomatoes.**—*Agric. Gaz. N.S.W.* **47** pt. 12 pp. 694–695. Sydney, December 1936.

Smooth tomatos that had been dusted with lead arsenate in New South Wales were found to carry a residue equivalent to 0·025–0·180 grains arsenic trioxide per lb. After thorough wiping with a dry cloth, the residue was reduced to about 0·01 for sound fruit, but ranged from 0·008 to 0·033 for fruit containing cracks. Dipping tests were carried out with tomatos (both sound and cracked) that had received weekly sprays of lead arsenate with and without casein-lime spreader, and carried residues of well over 0·01 grains arsenic trioxide per lb. They were placed in a wooden case with sufficient space between the boards to allow for free movement of the solution and quick draining. They were immersed for 1½ minutes in 1 per cent. hydrochloric acid solution, the case being plunged up and down during this time, allowed to drain for 1–2 minutes, and then transferred for about a minute to a tub containing 10 gals. water and ¼ lb. hydrated lime. On removal from the lime dip, they were sluiced with clean water from a knapsack spray outfit. This treatment reduced the arsenic residue to not more than 0·003 grains per lb. The lime contained in the spray residues diminished the strength of the acid bath, but about 12 bushels of heavily sprayed fruit can be passed through every 8 gals. of the solution before it needs renewing or strengthening. Several classes of fruit were used, all giving similar results, and the tomatos had a good clean appearance, superior to that obtained by wiping. Sound and scarred tomatos, both green and coloured, were not injured by dipping, and cracked fruits were not appreciably affected when dried quickly before packing.

Annual Reports of the Sub-department of Prickly-pear Land Commission for the Years ended 30th June 1933–30th June 1936.—*Rep. Land Adm. Bd Qd* 1932-33–1935-36. Fol., 4 nos. Brisbane, 1933–1936. [Recd. 1937.]

Sections of these reports deal with the continued success of the biological control of prickly-pear in Queensland [*cf. R.A.E.*, A **25** 78, etc.]. As *Cactoblastis cactorum*, Berg, has become widely established, the numbers of eggs sent out for distribution [*cf.* **20** 157] has been reduced; it was 1,185,000 in 1932–33 and 480,000 in 1935–36. Scarcely a trace remains of the two most prevalent species, *Opuntia inermis* and *O. stricta*, in very large areas where formerly there was a dense undergrowth of pear, over 17,000,000 acres of land having now been reclaimed. Wherever regrowth occurs, it is well infested with *Cactoblastis*, but increase in growth of seedlings or scattered plants may at first be rapid, as the building up of a sufficient infestation to control the outbreak may take some little time. Mild winters and an absence of heat waves in the summer are favourable to the development of the Pyralid.

The cochineal insect, *Dactylopius* sp., is slowly effecting a noticeable reduction in dense areas of the tree-pears (*O. tomentosa* and *O. streptacantha*) in Central Queensland. A strain of *Dactylopius confusus*, Ckll., was introduced from South America for the control of tiger-pear (*O. aurantiaca*), and in several places where it has been liberated experimentally, destruction of the plants has resulted. In one locality, *Cactoblastis* caused considerable damage to dense growths of tiger-pear, destroying not only the aerial growth but also the underground bulbs [*cf.* **20** 157]. Another Pyralid, *Tucumania tapiacola*, Dyar, has been introduced from South America, and, together with a strain of *Dactylopius ceylonicus*, Green (*indicus*, Green), is being bred for experiments on the control of the same species.

DE FLUITER (H. J.). **Onderzoekingen omtrent de witte luizen van de koffie.** [Investigations on Coffee Mealybugs.]—*Bergcultures* **10** no. 52 pp. 1630–1639, 2 graphs. Batavia, 1936.

In 1936, some further observations [*cf. R.A.E.*, A **25** 196] were made on mealybugs attacking coffee in Java, *viz. Ferrisiana virgata*, Ckll., from which an unidentified Hymenopterous parasite was obtained, *Pseudococcus filamentosus*, Ckll., and particularly *P. citri*, Risso. *P. citri* was scarce or absent in places where it had been abundant in 1935 and common in others where it had been scarce. Such periodicity has been observed during six years. The east monsoon was dry in 1935 and wet in 1936, and observations in both years suggest that conditions are favourable for *P. citri* when the monthly average air humidity at noon is below 60–65 per cent. The predacious larvae of the Cecidomyiid, *Coccodiplosis pseudococci*, de Meij., and the larvae and adults of a Coccinellid of the genus *Scymnus* were the most important natural enemies of *P. citri*. The egg, larval and pupal stages of *Scymnus* were completed in 4–6, 9–12 and 6–7 days, respectively. The females began to oviposit soon after emergence, lived for 2–3 months and laid up to 230 eggs. The larvae of this Coccinellid are parasitised by an Encyrtid of the genus *Homalotylus*.

HUTSON (J. C.). **Entomological Notes.**—*Trop. Agriculturist* **87** no. 5 pp. 289–295, 2 refs. Peradeniya, November 1936.

Notes are given on the bionomics of certain insect pests in Ceylon and measures are suggested for their control. *Dacus cucurbitae*, Coq., lays eggs in batches beneath the skin of the fruit of wild and cultivated cucurbits. The larvae tunnel in the fruit, causing it to decay, and pupate in the soil. The egg, larval and pupal stages last 1½–2, 4–5 and 8–10 days, respectively. Females begin laying about 4 weeks after emergence. The flies survived for several weeks with food in the laboratory, and in the field the period between crops is probably passed in the adult stage. A Braconid of the genus *Opius* has been bred from the larvae but does not control them. Two species of imported pupal parasites are being bred and liberated in some localities.

In May 1936, swarms of *Leptoglossus membranaceus*, F., injured the fruits of *Cyphomandra betacea* (tree tomato) and various species of *Citrus*, particularly orange, at high elevations, and oranges and vegetables at lower ones. A heavy fall of oranges resulted. Fruits and vegetables seem to have been attacked only for feeding. Breeding then occurred on bitter gourd (*Momordica charantia*) and snake gourd (*Trichosanthes anguina*). As *L. membranaceus* is not normally a pest, it appears that some natural control must have been upset by the drought in 1934 and early 1935. The eggs are laid in lines on the stems and leaf-stalks of cucurbits, and the nymphs hatch in about 9 days and pass through 5 instars in about 4–6 weeks. The adults are not sexually mature for 2–3 weeks. With food, they survive in the laboratory for several weeks, the females laying eggs at intervals.

Experiments on the control of *Dorylus orientalis*, Westw., which injures the underground parts of ornamental and vegetable plants [*cf. R.A.E.*, A **21** 405], have shown that the application of paradichlorobenzene at the rate of 1 oz. to 1 sq. yd. of soil kills the ants that are present at the time and protects the plants from re-infestation for several weeks if the weather is dry. In beds of growing plants, the fumigant should be sprinkled along shallow furrows between the rows at the rate of ¼ oz. for a yard of furrow, the soil then being replaced. For small shrubs and trees, it should be applied at the rate of ½–1 oz. per plant in shallow circular furrows with a radius of about 6–9 ins. from the stem. It may be mixed with soil to facilitate application.

LESTER-SMITH (W. C.). **Traps for the Black Beetle Pest of Coconut Palms.**—*Trop. Agriculturist* **87** no. 5 pp. 299–302. Peradeniya, November 1936.

It has been found in Ceylon that larvae of the coconut black beetle [*Oryctes rhinoceros*, L.] in decomposing organic material are sometimes killed by a green muscardine fungus [*Metarrhizium*], and it is suggested that this fungus be used in traps. These should be constructed by digging pits about 3 ft. square and 2 ft. deep and filling them loosely with alternate layers of cattle manure mixed with soil, and coconut branches, leaf stalks, leaves, and cut grass. Each double layer should be sprinkled with a decoction of the fungus, and the pit covered with leaves to prevent drying. The necessary inoculating material can be obtained from the Department of Agriculture. After 3 months, the pit should be opened and the decayed material removed. This can be

used to infest fresh material for other traps, each trap after 3 months providing sufficient infested material to infest 5 new ones. No traps should be left undisturbed for longer than 3 months in case the fungus should have been ineffective, as the minimum period of development of *O. rhinoceros* from egg to adult is $4\frac{1}{2}$ months.

ATKINSON (D. J.). **A Survey of the Damage to Teak Timber by the Beehole Borer** (*Xyleutes ceramica* **Wlk.**) **throughout the main Teak-bearing Forests of Burma** (**Lepidoptera-Cossidae**).—*Indian For. Rec.* (N. S.) Ent. **2** no. 1, 98 pp., 1 pl., 11 figs., 2 maps, 6 refs. Delhi, November 1936. Price 7*s.* 9*d.*

The results of an investigation carried out for several years on the varying incidence of damage caused by the larvae of the Cossid, *Xyleutes ceramicus*, Wlk. (beehole borer), to teak in Burma [*cf. R.A.E.*, A **24** 241] are here set out. The technique used in the amassing and analysis of the statistical data is described in detail, and particulars are given of findings in 56 different localities, a total of 1,001 trees being examined. The survey ranged from areas in which there was practically no damage to those in which it was extremely severe. In general, the incidence of damage increased with increasing rainfall, the optimum conditions for the moth seeming to lie between the isohyets of 70 and 110 ins. [*cf.* **24** 100], although in one locality, at the southern limit of teak in Burma, with an annual rainfall of 150 ins., there was almost no infestation, and in two others with an annual rainfall of 50 and 55 ins., respectively, teak was heavily attacked. Below 55 ins., the damage is likely to be tolerable in most localities. It is concluded that the artificial regeneration of teak should be discontinued in the heavy and upper moderate zones of incidence, and 12 Divisions are listed within the light and moderate zones in which regeneration should be successful. It is unlikely that rainfall can have any direct effect on the incidence of the Cossid, but it probably serves as an index of a meteorological complex that is really the controlling factor. This might be a combination of high temperature and low humidity, which would possibly cause a high mortality rate during the egg stage, the most vulnerable period in the life-history.

Observations on the influence of the aspect of the trees and of undergrowth on the incidence of attack have not given conclusive results. Forest fires have often been thought to diminish the numbers of the moth, but the incidence of infestation in the outer part of the trunks that have grown in the last 25 years since fire protection was initiated varies greatly, having increased in some and diminished in other localities. The author suggests that annually recurring forest fires must cause a heavy mortality amongst the ants that normally destroy great numbers of the eggs and first-instar larvae ; and that the disappearance of ants and other fauna of decaying wood must leave the plantations less attractive to woodpeckers, which are the chief natural enemies of the insect. Fire, by its action on undergrowth and the botanical succession may, however, modify the microclimate adversely to the moth, but at present there is not much reliable evidence of the effect of fire protection.

Mixed plantations do not appear to have any appreciable influence on the incidence of the borer. A comparison of infestation in plantation and natural timber showed that although, under similar

conditions, it was heavier in the former, it was not usually three times more than in the latter, as previous workers have surmised, and that the difference was less in heavily infested areas than in those that were only slightly attacked. The eggs are laid in masses, but the wandering habits of the larvae result in a dispersal of the attack, so that trees in the worst areas may suffer an average annual attack of four beeholes, but elsewhere it is exceptional for there to be more than one annually per tree.

Observations showed that the mean annual incidence of attack in individual trees rises steadily but very slowly, and that it does not increase as rapidly as the volume of the tree. Thus, whatever the incidence of attack, the faster the growth of timber the less the effect of any given degree of beeholing [*cf.* **10** 179]. It is therefore essential to encourage rapid growth in plantations by heavy and repeated thinnings; only in exceptional circumstances can naturally grown timber compete in rate of growth with that in plantations. Where it is unlikely that treatment will enable the volume increment to outstrip the borer increment, it is recommended that plantations should be abandoned.

The site of maximum beeholing showed a tendency to move up the trees with advancing age. The female moth consistently showed a negative geotropism in its search for oviposition sites, thus favouring the upper portions of the bole as against the lower. Little is known of the tropisms of the larvae, but it is thought that they tend to move up the trees to areas of the greatest flow of sap.

DESHPANDE (B. P.) & NADKARNY (N. T.). **The Spotted Boll-worms of Cotton (*Earias fabia* Stoll. and *Earias insulana* Boisd.) in South Gujarat, Bombay Presidency.**—*Sci. Monogr. imp. Coun. agric. Res. India* no. 10, iii+208 pp., 25 pls., 19 refs. Delhi, 1936. Price 9*s.* 6*d.*

A detailed report is given of investigations made from 1923 to 1934 on *Earias fabia*, Stoll., and *E. insulana*, Boisd., infesting cotton in South Gujarat, a summary of which has already been noticed [*R.A.E.*, A **24** 762]. Observations made in the course of this work on *Phycita infusella*, Meyr. (cotton shoot-roller) and *Platyedra gossypiella*, Saund., are recorded in appendices. *Phycita infusella* is well-established on cotton in South Gujarat and damaged 62 per cent. of the main shoots at Surat in 1925–26. The larvae bind the young leaves together and destroy the tiny growing buds, arresting the further growth of the shoots. Their incidence at Surat for 4 years beginning in 1927-28 is shown in tables. They apparently hibernate in rolled leaves, which dry up and fall with them from the plants. Young larvae appeared at the beginning of April, and the shoots of the standing cotton were infested until the seedlings of the next crop were 4–6 inches high and available as food. The population generally increased until the end of October and then declined. It is thought that effective control can be obtained by uprooting the cotton plants directly after harvest, so that there will be no food for the larvae when they emerge from hibernation.

Observations made over one season at Khandeesh indicated that *Platyedra gossypiella* is a more serious pest of cotton than *Earias* in that locality. In South Gujarat, however, it does not normally cause very serious damage, although it appears every year. The long-cycle larvae remain in seed cotton, cotton seed, and the dry bolls rejected

in the cotton fields. The main emergence of the moths takes place in July, and their numbers then decline, reaching a very low level in September and October. The cotton is sown at the end of June or the beginning of July, so that in July and August there is very little food for the larvae. Those produced by the few moths that emerge in September and October infest flower-buds and young bolls, but the infestation remains slight until December, when the developed bolls are available, the population then rising. It is thought that the long interval between the emergence of the adults and the presence of the developed bolls is the chief factor preventing this bollworm from becoming a serious pest.

Tsai (Pang-hwa). **Recent Trend in the Study and Control of Rice Borers in China.** [*In Chinese.*]—*Spec. Publ. nat. agric. Res. Bur. Minist. Ind. China* no. 16, 95 pp., 25 figs., 35 refs. Nanking, October 1936. (With a Summary in English.)

This report is divided into four sections : general discussion ; study on epidemiology ; control measures ; and practical methods of surveying and estimating the losses actually due to rice-borers. The three species concerned are *Schoenobius bipunctifer*, Wlk. (paddy borer), *Chilo simplex*, Btlr. (striped borer), and *Sesamia inferens*, Wlk. (purplish stem borer). The last two are widely distributed and appear regularly every year throughout the rice-growing regions of China, but the damage done by them is slight. *Schoenobius*, though it does not occur further north than the southern part of Shantung and Honan, is very destructive. It only attacks plants of the genus *Oryza*, and its development and distribution in China have been somewhat limited by climatic conditions and local farming practices. Recommendations for control include winter ploughing or winter irrigation of the rice-fields [*R.A.E.*, A **25** 231], the adoption of crop rotation in some localities, and a readjustment of the dates of sowing and transplanting in others.

Chu (Joo-tso). **Notes on Cheloninae of China, with Description of a new Species (Hymen., Braconidae).**—*Ent. & Phytopath.* **4** no. 35 pp. 682–685, 1 fig. Hangchow, 11th December 1936.

A description is given of the male of *Chelonus* (*Chelonella*) *jungi*, sp. n., which was reared from a cocoon of *Dendrolimus punctatus*, Wlk., in Chekiang, with records of the occurrence in eastern China of *Chelonus munakatae*, Munakata, from *Chilo simplex*, Btlr. ; *C.* (*Chelonella*) *pectinophorae*, Cushm., from *Platyedra* (*Pectinophora*) *gossypiella*, Saund., and *Earias cupreoviridis*, Wlk. ; *Phanerotoma philippinensis*, Ashm., from *Margaronia pyloalis*, Wlk. ; *P. flavida*, Enderlein, which is new to China, from *D. punctatus* ; and *P. flava*, Ashm., of which the host is unknown.

Ii (N.) **Notes on a new Chalcidoid-fly infesting the Egg of *Arge similis* Vollenhoven.**—*Kontyû* **10** no. 5 pp. 221–225, 3 figs., 3 refs. Tokyo, September 1936.

Descriptions are given of the adults of both sexes of the Eulophid, *Ootetrastichoides habachi*, gen. et sp. n., parasitising the eggs of *Arge similis*, Voll., on azalea near Tokyo [*cf. R.A.E.*, A **23** 208, etc.], together with characters distinguishing the genus from *Ootetrastichus*, to which it appears to be closely related.

MURATA (T.). **Notes on Rice Leafhoppers. I & II.** [*In Japanese.*]—*J. Plant Prot.* **24** nos. 1–2 pp. 18–24, 101–107. Tokyo, January–February 1937.

The brachypterous forms of the Delphacids that attack rice in Japan have been known since 1900. The brachypterous females of *Sogata furcifera*, Horv., and *Delphacodes striatellus*, Fall., produce rather more eggs than the macropterous females. The brachypterous forms of the latter seem to occur more frequently when fewer individuals are reared in a cage, and many emerged, especially males, from nymphs that had hibernated. The stage in which *S. furcifera* and *Nilaparvata oryzae*, Mats., hibernate has not been ascertained.

ODA (F.). **On some Problems of *Grapholitha molesta* Busck in recent Times.** [*In Japanese.*]—*J. Plant Prot.* **24** no. 1 pp. 32–39, 2 figs. Tokyo, January 1937.

An account is given of the studies that have been carried out on *Cydia* (*Grapholitha*) *molesta*, Busck, in Japan, where it is very injurious to pear and apple and has been known as a pest since 1900. In some districts it has caused serious injury to peach in recent years, and has also attacked loquat (*Eriobotrya japonica*) and the buds of pear. In addition to Japan, it has been found in Manchuria, Formosa and Korea. In northern Kyushu, there seem to be 6 or more generations a year, the adults being present from April to November.

YUASA (H.). **Old Record of the Outbreak of the Soy Bean Cecidomyiid.** [*In Japanese.*]—*J. Plant Prot.* **24** no. 2 pp. 111–113. Tokyo, February 1937.

Outbreaks of an unidentified Cecidomyiid that is injurious to soy beans in the northern half of Honshu and in Hokkaido seem to occur at intervals of about 7 years. It was recorded in Fukushima Prefecture in 1881.

ISHIBASHI (R.). **On the Host Plants of *Icerya purchasi* Mask.** [*In Japanese.*]—*J. Plant Prot.* **24** no. 2 pp. 120–126. Tokyo, February 1937.

Icerya purchasi, Mask., has recently been found in the Saitama Prefecture, north of Tokyo, where it attacks 112 different plants belonging to 48 families.

ISHII (T.). **On the natural Enemies of *Prontaspis yanonensis*, Kuw.** [*In Japanese.*]—*Agric. & Hort.* **12** no. 1 pp. 60–70, 12 figs. Tokyo, January 1937.

An account is given of further observations on the insects predacious on *Prontaspis yanonensis*, Kuw. [*cf. R.A.E.*, A **20** 247], which is very injurious to *Citrus* in Japan. The most important is *Chilocorus kuwanae*, Silv., all stages of which are described. It hibernates in the adult stage. The rate of development varies with the season, the egg, larval and pupal stages lasting 7–19, 17–29 and 5–8 days, respectively. An individual destroys an average of 60·6 Coccids during larval development and 87 during adult life, which lasts about a month. A female lays about 35 eggs in 18 days, usually depositing them

singly underneath the scale of *Prontaspis*. The adults also feed on *Aonidiella* (*Aspidiotus*) *perniciosa*, Comst., *Aulacaspis* (*Diaspis*) *pentagona*, Targ., and other Coccids and on Aphids. Up to 51 per cent. of the larvae are sometimes parasitised by *Homalotylus flaminius*, Dalm., which also attacks *Coccinella septempunctata brucki*, Muls. All stages of this Encyrtid are described. It is itself parasitised by a Calliceratid of the genus *Lygocerus*, which, like its host, has 4 generations a year.

The other predators attacking *P. yanonensis* are *Scymnus* sp., which has 2 or 3 generations a year, *Platynaspis nigra*, Weise, which appears to have 3, Nitidulids of the genus *Cybocephalus*, and *Chrysopa boninensis*, Okam. *Scymnus* is parasitised by *Anisotylus albifrons*, Ishii, *Cybocephalus* by *Aphanogmus* sp., and *Chrysopa boninensis* by *Isodromus axillaris*, Timb., and *Hemiteles* sp.

SAKIMURA (K.). **The Life and seasonal Histories of** *Thrips tabaci* **Lind. in the Vicinity of Tokyo, Japan.**—*Oyo-Dobuts. Zasshi* **9** no. 1 pp. 1–24, 8 figs. Tokyo, February 1937.

Thrips tabaci, Lind., is widely distributed in Japan, Korea and Formosa, and also occurs in the Loochoo Islands, Saipan and Palau (Micronesia), but no males have been found there. Studies on its bionomics near Tokyo showed that it produces at least 10 overlapping generations annually on onions, which are cultivated all the year round and are also attacked by other thrips, including *Taeniothrips alliorum*, Priesn. It is scarce during late autumn and winter, but abundant from late June to early August, particularly in mid-July, when it retards the growth of the seedling plants. During August and September, the egg stage lasts 3·6–6·5 days, the larval 6·4–13·5, the prepupal 1·2–2·8 and the pupal 3·2–6·3, and the adults lay 23–119 eggs. When the temperature falls, the preoviposition is prolonged, and the total number of eggs laid decreases. Natural enemies observed included the Eulophid parasite, *Thripoctenus brui*, Vuillet, which is of considerable importance, and a mite, *Anystis astripus*, Ksch.

SHIBATA (K.). **Notes on the Autecology of some Fruit-flies. IV. On the Velocity and Threshold of Development of Eggs of** *Chaetodacus cucurbitae* **Coq. (Melon Fly).** [*In Japanese.*]—*J. Soc. trop. Agric.* **8** no. 4 pp. 373–380. Taihoku, 1936.

In continuation of previous observations on *Dacus* (*Chaetodacus*) *cucurbitae*, Coq., in Formosa [*R.A.E.*, A **24** 122], experiments were made on the effect of different constant temperatures on the development of eggs and larvae, starting with eggs laid in cucumber at 27–28°C. [80·6–82·4°F.]. The average duration of the egg stage in hours was 20·1 at 32°C. [89·6°F.], 20·9 at 30°C. [86°F.], 46·3 at 20°C. [68°F.] and 190·4 at 12°C. [53·6°F.]. The larvae matured in 3·09, 3·31, 5·85 and 14·49 days at 32°C., 30·5°C. [86·9°F.], 20°C. and 12°C., respectively.

YOHENA (C.). *Sphenophorus maculatus* **Mats. injurious to Palms.** [*In Japanese.*]—*Insect World* **41** no. 2 pp. 42–43. Gifu, February 1937.

Rhabdocnemis (*Sphenophorus*) *maculatus*, Gylh., causes considerable injury to the stems of palms in the Marianna Islands, and is said to be a serious pest of sugar-cane in the Bonin Islands.

TAKAHASHI (R.). **Some Aleyrodidae, Aphididae, Coccidae (Homoptera), and Thysanoptera from Micronesia.**—*Tenthredo* **1** no. 2 pp. 109–120, 2 figs. Kyoto, November 1936.

Records are given of 5 Aleurodids, 5 Aphids, 29 Coccids and 2 Thysanoptera collected in Micronesia, showing the islands and, in most cases, the plants on which they were taken. A new genus and 2 new species of Aleurodids and a new species of thrips are described. The Aleurodids include *Bemisia tabaci*, Gennadius, which was found on cabbage in the Marianna Islands and of which the author considers *B. gossypiperda*, Misra & Lamba, and *B. hibisci*, Takah., to be synonyms.

YANAGIHARA (M.). **Results of Studies on the Distribution of Soil Insects of Sugar-cane Fields in Formosa.** [*In Japanese.*]—*J. Formosan Sug. Plant. Ass.* **14** no. 9 pp. 341–424, 17 figs. Taichu, Formosa, September 1936.

A list is given of 379 soil insects and many other animals collected in sugar-cane fields throughout Formosa, with brief notes on the biology and economic status of some of the important species and the relation of climatic and soil factors to their local distribution. They include two Onychiurids that feed on the young rootlets ; *Gryllotalpa formosana*, Shir., which occurs in dry fields and is injurious from September to July ; the earwigs, *Euborellia pallipes*, Shir., which feeds on the sugar-cane, as well as preying on Pyralid borers, and *Proreus simulans*, Stål, which is entirely predacious ; *Coptotermes formosanus*, Shir., which sometimes attacks sugar-cane ; *Reticulitermes* (*Leucotermes*) *speratus*, Kolbe, which is not found in the southern part of the Island ; and *Ischnodemus saccharivorus*, Okaj., which appears to be confined to the regions with heavy precipitation, being absent in the south-west.

TAKAHASHI (R.). **Kurze Uebersicht der gegenwärtigen Kenntnisse über die Vorratsschädlinge auf der Insel Formosa.** [A brief Survey of present Knowledge of Store Pests in the Island of Formosa.]—*Mitt. Ges. Vorratsschutz* **13** no. 1 pp. 4–6. Berlin, January 1937.

In Formosa, the most important pests of stored cereals are *Sitotroga cerealella*, Ol., *Ephestia cautella*, Wlk., *Calandra oryzae*, L., *Tribolium castaneum*, Hbst. (*ferrugineum*, F.), *Laemophloeus ferrugineus*, Steph., and *Rhizopertha dominica*, F. Some injury is caused by *Tenebroides mauritanicus*, L., and *Carpophilus obsoletus*, Er., but *Tinea granella*, L., and *Calandra granaria*, L., have only been observed on rare occasions. Flour is also attacked by *Sitodrepa panicea*, L., and *Oryzaephilus surinamensis*, L. *C. oryzae* has about 8 generations a year, all stages being found together at all seasons. *T. castaneum* has about 4 generations, and in the northern part of the Island it hibernates in the adult stage.

Among several species of Bruchids, the most injurious is *Bruchus chinensis*, L. It attacks various beans, but prefers *Phaseolus radiatus* and *P. vulgaris*. Its life-cycle requires 20 days in summer and 60 in winter. A species of *Pteromalus* parasitises the larvae. Other pests include the Pyralid, *Mampava bipunctella*, Rag., which infests Italian millet [*Setaria italica*] in the field and in the warehouse, *Cylas*

formicarius, F., which is a serious pest of sweet potato [*R.A.E.*, A **22** 520], *Dermestes cadaverinus*, F., which feeds on dried fish, and *Coptotermes formosanus*, Shir., which is very destructive to woodwork, including the timber of buildings.

VAPPULA (N. A.). *Trigonogenius globulus* **Sol. in Finnland angetroffen.** [*T. globulus* found in Finland.]—*Mitt. Ges. Vorratsschutz* **13** no. 1 pp. 10–11, 1 fig. Berlin, January 1937.

The Ptinid, *Trigonogenius globulus*, Sol., has been found infesting imported caraway seeds in Finland, but had apparently caused only slight injury to them.

HUKKINEN (Y.). **Tutkimuksia nurmipuntarpään** (*Alopecurus pratensis* **L.**) **siementuholaisista. 1.** *Chirothrips hamatus* **Tryb., puntarpääripsiänen.** [Investigations on the Seed Pests of the Meadow Foxtail Grass, *A. pratensis*. 1. *C. hamatus*.]—*Valt. Maatalousk. Julk.* no. 81, 132 pp., 9 pls., 13 pp. refs. Helsinki, 1936. (With a Summary in German.)

Investigations in Finland showed that reduction in the quantity and quality of the seed of *Alopecurus pratensis* is caused not only by the Cecidomyiid, *Dasyneura alopecuri*, Reut., but also by other insects, particularly Thysanoptera. The most important was *Chirothrips hamatus*, Tryb., all stages of which are described. It was the predominant thrips on *A. pratensis* and was far more abundant in the ears than in the leaf-sheaths. Other species included *Limothrips denticornis*, Hal., which infested the leaf-sheaths, *C. manicatus*, Hal., and *Haplothrips aculeatus*, F., which were chiefly found in the ears, and *Aptinothrips rufus*, Gmel., which was evenly distributed between ears and leaf-sheaths. Descriptions are given of the chief types of partial white-ear produced in *A. pratensis* by Thysanoptera, and of the morphology of the different species, which governs their ability to move inside the leaf-sheath and the ear.

The bionomics of *C. hamatus* are described in detail. The white-ear due to extrafloral injury caused in spring by the hibernated adults may result in a considerable loss of seed. The intrafloral life of this thrips begins when the females oviposit in the ears. Males occur, but reproduction is mainly parthenogenetic. All the developmental stages are passed in the ears, and the new adults remain in them until the following spring. Up to 58·2 per cent. of the larvae and pupae were destroyed by a Hymenopterous parasite. The intrafloral injury done by *C. hamatus* varied from 25·4 per cent. in 1932 to 36·8 per cent. in 1934, the corresponding percentages for *Dasyneura alopecuri* and *Stenodiplosis geniculati*, Reut., being 19·2 and 13·8, and those for other intrafloral pests 0·3 and 1·9.

VALLE (O.). **Untersuchungen zur Bekämpfung von Samenschädlingen verschiedener Kleearten.** [Investigations on the Control of Seed Pests of various Clovers.]—*Maataloust. Aikakausk.* **8** pp. 195–209, 4 refs. [Helsingfors] 1936. (With a Summary in Finnish.)

Experiments with Cryocide were carried out in Finland in 1926 against *Apion apricans*, Hbst., and *A. flavipes*, Payk., which are pests of the seeds of red clover (*Trifolium pratense*) and alsike clover (*T. hybridum*), respectively. Cryocide contains 90 per cent. cryolite

(Na_3AlF_6) and 44 per cent. of the active constituent, fluorine, and was applied as a dust mixed with 15 per cent. talc and 5 per cent. fine clay [*cf. R.A.E.*, A **24** 440]. The average number of weevils taken by 25 sweeps with a net was the unit for counts made before and after dusting.

On red clover, sweeping on 15th June 1936 yielded averages of 23·8 of *A. apricans* and 0·5 of *Hypera* (*Phytonomus*) sp., or 24·3 for these two seed pests together. The effect of dusting on 18th June was nullified by heavy rain on the following day, and two further applications were made. Sweeping of dusted and untreated plots showed 5·9 and 19·2 seed pests, respectively, after the second application and 4·4 and 21·2 on 1st July after the third. *A. apricans* represented 97·9 per cent. of the two seed pests. Subsequent infestation of the clover heads was reduced by over 70 per cent. in the dusted plots, and the yield of seed was increased by 13 per cent.

In similar experiments on alsike clover, sweeps before dusting yielded averages of 33·2 of *A. flavipes*, 0·2 of *Hypera* sp. and 6·3 of *Tychius* (*Miccotrogus*) *picirostris*, F., or 39·8 for these three seed pests. The combined averages in the dusted and untreated plots were 4 and 28·8, respectively, after the second application and 1·3 and 25·7 after the third. *A. flavipes* represented 86·3 per cent. of the three seed pests.

KANGAS (E.). **Ueber die Braunfleckigkeit der Laubhölzer.** [Brown Fleck of deciduous Trees.]—*Ann. ent. fenn.* **3** no. 1 pp. 33–39, 4 figs., 8 refs. Helsingfors, 1937.

In continuation of investigations on brown fleck of deciduous trees in Finland [*cf. R.A.E.*, A **23** 439], the Anthomyiid, *Phorbia* (*Hylemyia*) *florilega*, Zett., was apparently bred from aspen (*Populus tremula*) in 1936, but this is subject to verification. The species of *Agromyza* (*Dendromyza*) are reviewed in connection with brown fleck, and it is suggested they may possibly be specific to various species of deciduous trees, as willow and birch did not yield the same species. The distinctness of these species, the status of the subgenus *Dendromyza* and the general literature on the subject of brown fleck are discussed. The bionomics of the various species [*cf. loc. cit.*] are similar.

SAALAS (U.). **Weitere Beiträge zur Kenntnis der an *Rhododendron* lebenden *Stephanitis*-Arten (Hem., Tingitidae).** [Further Contributions to the Knowledge of *Stephanitis* spp. on *Rhododendron*.] —*Ann. ent. fenn.* **3** no. 1 pp. 45–46. Helsingfors, 1937.

Two further instances of infestation of *Rhododendron* by *Stephanitis oberti*, Kol., in Finland [*cf. R.A.E.*, A **24** 519] were observed in 1936, one being on fairly young plants that had been imported from a nursery in Saxony. Correspondence showed that this Tingid occurred on *Rhododendron* there, as also did *S. rhododendri*, Horv. Some characters distinguishing the two species are reviewed.

THALENHORST (W.). **Senföl (Allylisothiocyanat) als Kampfmittel gegen den Maikäferengerling.** [Mustard Oil (Allyl Isothiocyanate) as a Means for combating Melolonthid Larvae.]—*Anz. Schädlingsk.* **13** no. 2 pp. 15–17, 3 refs. Berlin, February 1937.

The preliminary results are recorded of an investigation in Prussia of the minimum lethal doses of various soil fumigants for the third-instar larvae of *Melolontha hippocastani*, F. In the laboratory, the

larvae were exposed in closed glass dishes at a temperature of 22–24°C. [71·6–75·2°F.]. When poisoned, they were placed in earth until they died or recovered completely. The minimum lethal doses in mgm. per litre and (in brackets) the time in hours required for poisoning were : mustard oil (allyl isothiocyanate) 3 (24), naphthalene 81 (288), chloropicrin 5 (24), carbon bisulphide 262 (24), paradichlorobenzene 187 (72), hexachlorethane 166 (96), carbon tetrachloride > 1,775 (120), and orthodichlorobenzene 310 (72). The poisons are arranged in order of cost per 1,000 minimum lethal doses.

In field experiments with five of the fumigants, larvae in wire cages were buried at a depth of 10 ins. in the ground in a circle with a radius of 6–10 ins. and the fumigant was introduced in the centre. The weather was warm and the soil dry. The quantity introduced and (in brackets) the percentage mortality after 28 days were : mustard oil 0·5 cc. (97), carbon bisulphide 10 cc. (47), chloropicrin 0·5 cc. (97), paradichlorobenzene 5 gm. (83), and hexachlorethane 5 gm. (3). The poisons are given in order of cost for fumigating large areas and the results with mustard oil justify further work. It emulsifies readily with soap and water, and an emulsion would facilitate the application of the small quantities required, but its effect in this form has not been tested. One-year-old pines did not appear to suffer from treatment with it.

Schedl (K. E.). **Zur Bekämpfung des Kiefernprozessionsspinners.** [The Control of the Pine Processionary Caterpillar.]—*Anz. Schädlingsk.* **13** no. 2 pp. 18–20, 1 diagr. Berlin, February 1937.

The author records some observations on *Thaumetopoea pinivora*, Treit., attacking pines on the coast of East Prussia, where it is abundant and, though of no importance as a forest pest, has caused annoyance to visitors at a seaside resort, so that attempts have been made to control it. The eggs are laid on exposed terminal shoots, especially at the edges of stands, along roads, etc. The moth has a two-year life-cycle, the egg stage lasting from about June to March and the pupal stage from September to May, and as two different stages thus always occur contemporaneously, any measures would have to be carried out for two years. In experiments, dusts of calcium arsenate or contact poisons did not prove effective. Good results having been obtained in this district by planting deciduous trees under pine, it is considered that a gradual change from pure pine stands to mixed ones should effect control.

Herold (W.). *Blaniulus guttulatus* (**Bosc**) **als Schädiger keimender Erbsen.** [*B. guttulatus* as a Pest of germinating Peas.]—*Anz. Schädlingsk.* **13** no. 2 p. 22. Berlin, February 1937.

The spring of 1936 was cold and wet in the island of Usedom, Pomerania, and the millepede, *Blaniulus guttulatus*, Bosc, attacked germinating peas and lettuce in May. The infestation ceased with the advent of warm weather in June.

Nitsche (G.) & Mayer (K.). **Untersuchungen über Blattwanzen als Getreideschädlinge.** [Investigations on Leaf Bugs as Cereal Pests.]—*NachrBl. dtsch. PflSchDienst* **17** no. 2 pp. 13–16, 13 figs. Berlin, February 1937.

As some injury due to bugs was found in 34 out of 36 samples of summer and winter wheat of the crop of 1935 in the district of Guhrau,

German Silesia, bugs were collected in June 1936 in fields of wheat, rye and barley. The species found were *Eurygaster maura*, L., and *Aelia acuminata*, L., which were the most common, *A. rostrata*, Boh., *Carpocoris pudicus fuscispinus*, Boh., *Palomena prasina*, L., *Dolycoris baccarum*, L., *Syromastes* (*Mesocerus*) *marginatus*, L., and *Eurygaster austriaca*, Schr., which was taken once only. A list is given of a number of other plants on which several of them occurred. Some of the bugs oviposited in the laboratory, and a key is given to the eggs of all the species except *E. austriaca*. Single individuals of *E. maura* and *A. acuminata* were confined on wheat ears in the field in order to ascertain the effect of feeding. The injured grains are divided into 4 groups : glassy or floury ; with puncture spots ; deformed ; or shrivelled. A table shows for 11 varieties of winter wheat and 6 of summer wheat what percentage of injured grains belonged to each group.

Balachowsky (A.). **La rupture expérimentale de la diapause chez le carpocapse ou " ver des pommes."**—*C. R. Acad. Sci. Fr.* **204** no. 4 pp. 294–295, 2 refs. Paris, 1936.

Termination of the diapause in hibernating larvae of *Cydia* (*Laspeyresia*) *pomonella*, L., taken in France in December 1936 was obtained by exposing them to —4°C. [24·8°F.] for 8 days, to —10°C. [14°F.] for a further 8 days and then to 25°C. [77°F.] for 16 days, when they pupated, producing normal adults 10 days later. Throughout the experiments, a relative humidity of 75 per cent. was maintained, and the mortality rate was not more than 20 per cent. This method of terminating the diapause makes it possible to breed the moth at all seasons for biological investigations.

[Steinberg (D.).] **Штейнберг (Д.). The Possibilities of the Sugar Beet Web Worm's** (*Loxostege sticticalis* **L.) Propagation in the Virgin Steppes of the Kalmuik Autonomous SSR.** [*In Russian.*]—*Bull. Plant Prot.* (1 Ent.) no. 13, 68 pp., 16 figs., 38 refs. Leningrad, 1935. (With a Summary in English.)

An account is given of observations in 1932–33 on the propagation and fecundity of *Loxostege sticticalis*, L., on wormwood (*Artemisia* spp.) in the Kalmuik Steppe (former Department of Astrakhan). Data are given on weather and the flowering of plants, and also on the phenology of the moth. In 1932, the adults of the overwintered generation emerged in May, under conditions of high humidity not typical for the locality, and produced a large brood that fed at the beginning of July, but the resulting moths were sterile, owing to drought and lack of nectar from flowers. Their place was taken by immigrant moths that were highly prolific, and about 60 per cent. of the larvae produced entered the diapause in August. The adults that emerged in the spring of 1933 were sterile, owing to dry cold weather typical for the region, but a fresh outbreak was caused by an invasion from the north-west in June–July, and the resulting infestation was higher than in 1932. The larvae of the new generation were largely destroyed by heavy rainfall during cocoon formation, the few females that emerged being sterile.

Investigations on malnutrition during the larval stage, thought to be a rare occurrence in this region, showed that the earlier generation in 1932 must have been under-fed and in more favourable circumstances

would have had a greater fecundity. The average weights of pupae from larvae fed on *Atriplex*, sugar-beet and *Artemisia* at 28–30°C. [82·4–86°F.] were 35, 30·4 and 20·07 mg., respectively. At lower temperatures, these weights were considerably increased, but the proportion remained constant. Thus, other conditions being equal, females fed on *Artemisia* in the larval stage have a lower potential fertility. In notes on the life-cycle in this region, the author considers the fifth instar to be a critical period, as many larvae perish when entering the ground. The degree of infestation, however, is dependent on the adult stage, as lack of humidity results in sterility. New outbreaks are possible only through invasion from outside, and there is no permanent life-cycle in the wormwood steppe.

The author gives notes on the flight of the moths [*cf. R.A.E.*, A **24** 816; **25** 273] and the cycle of sexual development [*cf.* **21** 160], and describes experiments demonstrating the dependence of the size and number of the oöcytes on pupal weight [*cf.* **25** 275], the effect of the absence of water on fertility, and the loss of body-fluid through evaporation. Solar radiation and low humidity may retard the process of egg-maturation in nature, but a plentiful supply of nectar should compensate for this [*cf.* **25** 273]. When humidity is low and the concentration of the nectar high, females are practically without access to water, and the longer these conditions persist, the greater will be the degree of degeneration of the oöcytes. At temperatures above 32°C. [89·6°F.] pairing and egg-maturation do not take place, while below 17°C. [62·6°F.] the moths do not feed and the oöcytes die [*cf.* **22** 373.]

[Kulagin (N. M.).] **Кулагин (Н. М.). The Effect of Moisture on the Development of Insects.** [*In Russian.*]—*Zap. belorussk. Akad. Nauk* no. 3, 1934. (Abstr. in Russian in *Abstr. Wks zool. Inst. Moscow St. Univ.* no. 3 p. 189. Moscow, 1936.)

An account, based on the literature and personal observations, is given of the effect of humidity on the eggs, larvae, pupae and adults of a large number of different insects. It is concluded that, as the development of insects is a combination of a number of physiological processes, the interactions of which are constantly changing, the duration of development of an insect cannot be completely determined by temperature and humidity. The effect of these factors is marked at some periods in the course of development and insignificant at others.

[Zolotarev (E. Kh.).] **Золотарев (Е. Х.). On the Causes of the Mass Appearance of the Migratory Locust (*Locusta migratoria* L.) in the Western Region in 1933 and of its Disappearance in 1934.** [*In Russian.*]—*Abstr. Wks zool. Inst. Moscow St. Univ.* no. 3 pp. 197–218, 8 refs. Moscow, 1936. (With a Summary in English.)

Swarms of *Locusta migratoria*, L., were present in the Western Province of Russia in the summer of 1933 and oviposited over an area of over 10,000 acres, but the locust did not re-appear in 1934. Detailed ecological studies have shown that the breeding grounds in this region, which is at the northern limit of the distribution of the species, and where the lower ground is covered by mixed forests, are confined to arable fields and sandy areas occupying higher ground [*cf. R.A.E.*, A **19** 333].

The summers of 1931 and 1932 were warmer and drier than usual, so that the females were able to lay several egg-pods, and small swarms had appeared in 1932. In 1933, cool and humid conditions prevailed at the time of oviposition, which was confined to the warmest and driest parts of the higher ground. In winter, such spots are not protected by snow cover, which is blown off them, and in this instance the eggs were killed by frost.

[Stepantzev (I. N.).] **Степанцев (И. Н.). Control of** *Epitetranychus althaeae.* [*In Russian.*]—*Sotzial. Nauk. Tekh.* **4** no. 7 pp. 5–19. Tashkent, 1936. (With a Summary in English.)

Observations in Uzbekistan in 1935 showed that the optimum conditions in July–August of mean daily temperature, humidity and atmospheric pressure (expressed as altitude) for the red spider on cotton, which is here regarded as *Tetranychus telarius*, L. (*Epitetranychus althaeae*, v. Hanst.) [*cf. R.A.E.*, A **25** 146], are 27·5°C. [81·5°F.], 48 per cent. (or 39 per cent. at 1 p.m.), and 660 ft. above sea-level, respectively. From these data, and taking local variations into consideration, the author constructs a formula for the probable infestation in a given year, that was confirmed by the actual figures for 1929–35. The deflections from these optima are used to build up a formula to calculate the area of infestation. The meteorological data for July–August 1928–35 show a three-year cycle, the years 1928, 1931 and 1934 being characterised by a higher humidity and a lower temperature. These conditions caused a reduction in the degree of infestation by the mite, while the intermediate years were favourable to it. The author observed an alternation of spring and summer generations, the latter requiring a slightly lower atmospheric humidity than the former, but this difference is not mathematically significant.

[Lazarov (A. V.).] **Лазаровъ (А. В.). Kurzer Beitrag zur Kenntnis der Schädlichkeit der gelben Halmfliege,** *Chlorops taeniopus* **Meig.** [A short Contribution to the Knowledge of the Damage caused by *C. taeniopus*.] [*In Bulgarian.*]—*Mitt. bulg. ent. Ges.* **9** pp. 1–10, 3 figs., 6 refs. Sofia, 1936. (With a Summary in German.)

Chlorops taeniopus, Mg., is widely distributed in Bulgaria, being especially abundant in districts with a cool and humid climate. It is generally thought that it is often responsible for a considerable reduction in the yield of wheat and barley, but the investigation here described, which was carried out near Sofia in July 1935, does not confirm this view. There are three generations a year in this district, the adults occurring in April–May, June–July and September–October. The chief food-plants are wheat and barley; rye is seldom infested, and usually only by larvae of the third generation, which also attack certain grasses. Eggs are laid on the upper surface of the top leaves and the newly hatched larvae make their way into the stems; as a rule, only one develops in a given stem. The larval stage of the first and second generations lasts 6–7 and 5–6 weeks, respectively, and that of the hibernating generation up to 6 months. The infested shoots are stunted and thickened from the top to the first node, and the normal nutrition of the ears and grain is impaired by the feeding of the larvae. The observations on the effect of the infestation were carried out on

a Bulgarian variety of winter wheat sown in December 1934. In July 1935, 52 per cent. of the stems were attacked, but the weight of the grain from the infested plants was only 1·49 per cent. less than that from uninfested ones. The absolute weights of 1,000 grains each from infested and uninfested plants were almost equal. The infested stems were 22 per cent. shorter than the healthy ones owing to reduction in the length of the upper internodes, but were practically normal as regards the number of internodes and the length of the lower ones.

[Baĭlov (D.).] **Байловъ (Д.). Materialien zur Bekämpfung des Tabakblasenfusses** (*Thrips tabaci* **Lind.**). **1.** [Data on the Control of *T. tabaci*. I.] [*In Bulgarian.*]—*Mitt. bulg. ent. Ges.* **9** pp. 25–46, 10 refs. Sofia, 1936. (With a Summary in German.)

The severe losses caused to tobacco by *Thrips tabaci*, Lind., in Bulgaria [*cf. R.A.E.*, A **18** 153] are largely due to the planting out of seedlings that are already heavily infested. Experiments were therefore carried out in 1935 to test the value of immersing the seedlings for 2–6 minutes in various insecticides. A detailed account of the results is given, showing the percentages of mortality of the thrips obtained with each preparation. A 4 per cent. soap solution did not damage the plants and was very effective against the adults and larvae, but only killed a small percentage of the eggs. Tobacco decoction (5 lb. tobacco refuse to 24 gals. water) gave satisfactory results only if soap was added, and did not affect the eggs. Various emulsions of petroleum oil or tar distillates killed the thrips and their eggs, but severely scorched the plants. Milk of lime was sometimes effective against the adults, larvae and eggs, and sometimes unsatisfactory, as the lime dried out quickly or did not adhere. The best results were obtained with a proprietary insecticide the composition of which is not stated ; it gave complete control of the adults and larvae and a high mortality of the eggs, and did not injure the plants. It also proved of value as a spray against the thrips on fully-grown tobacco plants.

[Dryenski (P.).] **Дрѣнски (П.). Krankheiten und Schädlinge der Bienen in Bulgarien.** [Diseases and Pests of Bees in Bulgaria.] [*In Bulgarian.*]—*Mitt. bulg. ent. Ges.* **9** pp. 47–66, 1 map, 11 refs. Sofia, 1936. (With a Summary in German.)

This report deals with pests and diseases of honey-bees found in Bulgaria in 1932–35 ; the more important of the insect pests have already been noticed [*R.A.E.*, A **23** 489, 490].

[Statelov (N.).] **Стателовъ (Н.). Die Grundlagen der modernen Insektenepidemiologie.** [The Foundations of modern Insect Epidemiology.] [*In Bulgarian.*]—*Mitt. bulg. ent. Ges.* **9** pp. 69–130, 6 graphs, 103 refs. Sofia, 1936. (With a Summary in German.)

This is a detailed summary from the literature of recent investigations on the ways in which insect populations are affected by lack or abundance of food, soil conditions, natural enemies and diseases, and various climatic factors.

[Chorbadzhiev (P.).] **Чорбаджиевъ (П.). Materialien über die schädlichen Insekten und anderen Feinde der Kulturpflanzen in Bulgarien.** [Data on Injurious Insects and other Enemies of cultivated Plants in Bulgaria.] [*In Bulgarian.*]—*Mitt. bulg. ent. Ges.* **9** pp. 151–170, 2 figs., 1 ref. Sofia, 1936. (With a Summary in German.)

No serious outbreaks of insects occurred in Bulgaria during 1931–35. Of the usual pests, the more important were *Aporia* (*Ascia*) *crataegi*, L., and *Nygmia phaeorrhoea*, Don., on fruit trees; *Cydia* (*Laspeyresia*) *pomonella*, L., which attacked plums as well as apples and pears; *Thaumetopoea pityocampa*, Schiff., on pine; and *Thrips tabaci*, Lind., on tobacco. *Etiella zinckenella*, Treit., which has not previously caused appreciable injury in Bulgaria, was very abundant on soy beans in 1934. The damage was caused by the larvae of the second (overwintering) generation, the first having developed on other leguminous plants [*cf. R.A.E.*, A **18** 97]. In a botanical garden, the pods of 85–90 per cent. of the plants of *Lupinus angustifolius* were infested. In 1935, considerable injury to the one-year-old shoots of a great variety of young fruit trees and vines was caused by the slits made for oviposition by *Cicadella viridis*, L. This Jassid feeds on low-growing plants, to which the nymphs migrate as soon as they hatch; it has two generations a year and overwinters in the egg stage. Other pests that were more injurious than usual in Bulgaria included: *Tetranychus telarius*, L. (*althaeae*, v. Hanst.) on cotton, cucurbits, hemp, peas and crucifers; *Eriophyes tristriatus* var. *erineus*, Nal., on walnut; *Typhlocyba rosae*, L., on roses and fruit trees; *Deltocephalus striatus*, L., and *Tettigometra obliqua* var. *binotata*, Metcalf (*bimaculata*, Fieb.) on cereals; *Sesamia cretica*, Led., on *Sorghum*; *Sparganothis pilleriana*, Schiff., and *Clysia* (*Conchylis*) *ambiguella*, Hb., on vines; and *Chrysoclista* (*Blastodacna*) *putripenella*, Zell., on young apple trees.

Frappa (C.). **Sur l'emploi des émulsions savonneuses d'huiles végétales contre les pucerons et les chenilles dans nos possessions coloniales.**—*Agron. colon.* no. 227 pp. 141–145, 3 refs. Paris, November 1936.

In 1932–35, experiments were carried out in Madagascar to test the insecticidal value of vegetable oils produced locally [*cf. R.A.E.*, A **19** 519]. The toxicity of fatty acids for insects varies according to their chemical constitution, increasing with their molecular weight and, as a rule, with the number of carbon atoms in the molecule. The type of soap used for emulsification may also affect the action of the spray; soap has a mechanical effect on insects, as it blocks the stigmata, and sometimes also a chemical one, as the free alkali and aliphatic acids scorch the integument. In the colonies, soft soap is often too highly priced to be used; locally made soaps containing various fatty acids, always including coconut oil, were, however, effective. Tests were carried out with sprays of coconut, croton, ground-nut and castor oils, emulsified with soft, white and locally made soaps. Ground-nut and castor oils did not differ significantly in toxicity. Croton oil makes the emulsion more active but is not widely available. Coconut oil, containing lauric and capric acids, is very toxic, especially to Aphids, but in concentrations above 0·5 per cent. it increases the viscosity of

the emulsion so much that the spray nozzles become blocked. The formula recommended for use in Madagascar is 1 gal. second grade ground-nut or castor oil, 15 lb. locally made soap (of the same type as Marseilles soap) containing 0·1 to 0·3 per cent. coconut oil, and 80–120 gals. water. This has been used successfully against the Aphids, *Macrosiphum rosae*, L., on roses, *Brevicoryne brassicae*, L., on cabbage, *Aphis maidis*, Fitch, on maize, and *A. laburni*, Kalt., which attacks Lima beans [*Phaseolus lunatus*] and is thought to be the vector of a virus disease, and against Lepidopterous larvae, including *Prodenia litura*, F., *Achaea finita*, Gn., and *Boarmia selenaria*, Hb., all on ground-nuts, *Plusia* (*Phytometra*) *orichalcea*, F., on various vegetables, *Borocera madagascariensis*, Boisd., on guavas and young peaches, and *Papilio demodocus*, Esp., on *Citrus*. The young caterpillars died in less than 3 hours, and the large caterpillars of *P. demodocus* within 24 hours.

Attempts to control the polyphagous Coreid, *Anoplocnemis madagascariensis*, Sign., and the Pentatomid, *Antestia clymeneis* var. *galtiei*, Frappa, attacking coffee, with the same spray were unsuccessful [*cf.* **22** 626].

Bell (A. F.). **Report of the Division of Entomology and Pathology.**—*Rep. Bur. Sug. Exp. Stas. Qd* **36** pp. 19–23. Brisbane, 1936.

This report covers the period from 1st November 1935 to 30th June 1936. Owing to the hot dry weather that prevailed in Queensland during the previous summer being repeated to a rather less extent in November and December, the months when *Lepidoderma albohirtum*, Waterh., is emerging in most places, the numbers of beetles were much reduced and damage to sugar-cane by the larvae was negligible [*cf. R.A.E.*, A **24** 273]. In areas where emergence is very early, the spring rains allowed the beetles to emerge and oviposit before the onset of the hot weather, and damage to the cane occurred wherever this took place. Where the soil was very dry, the larvae concentrated under the stools, so that in some cases a single injection of fumigant [*cf.* **24** 436] per stool sufficed to kill them, and fumigation costs were considerably reduced. Tests carried out with a horse-drawn injector were unsatisfactory ; it was decided that future investigations should be directed to the possible improvement of hand-injectors. Fumigation is not economic in areas of slight infestation, and it is thought that the growth of stronger rooting canes would be the most profitable method of reducing injury there. Observations on the conservation of trash showed that the larvae tend to remain in the moister soil immediately below the trash and that concentration beneath the stools is delayed. When making population counts, it is therefore necessary to dig half way across the interspaces as well as to remove stools. In 180 acres of grassland some distance from the cane-fields, it was found that there were as many as 24,000 larvae per acre with an average of 3,000. In experiments in which sprays of lead arsenate, calcium arsenate, Paris green, and a proprietary mixture containing derris, all mixed with various adhesives, were applied to the foliage of trees on which the adult beetles feed, lead arsenate gave the best results. Paris green was nearly as good, but its action was slower and it is not so easily seen on the leaves. Spraying appeared to exercise no repellent action on the beetles. Parasites reared from them included *Palpostoma testacea*, R.-D., and *Sarcophaga calcifera*, Boettch.

Rhabdocnemis obscura, Boisd., was more abundant on sugar-cane in the Mackay area than it had been for two years. Lack of field sanitation probably contributes to heavy infestation early in the season. Hardness of the rind appears to increase the resistance of some varieties of sugar-cane to the borer and the possibility of selective breeding for this factor is being tested [*cf.* **24** 434].

Where satisfactory drainage of the cane-fields has not been carried out before the wet season, planting should be delayed to reduce infestation by *Lacon variabilis*, Cand. [*cf.* **24** 438]. Outbreaks of *Laphygma* (*Spodoptera*) *exempta*, Wlk., occurred sporadically throughout the cane belt of Queensland during the early months of the year. Most of the infestations were in grassland or in grassy leguminous crops grown for green manure [*cf.* **24** 620], and there was, as usual, only a slight invasion of the cane-fields. Crude oil sprays, rollers and bran baits were all successful in control, but were rendered superfluous by parasites, one species of Tachinid destroying 53 per cent. of the caterpillars. The larvae of a Carabid, *Chlaenius* sp., also attacked them in grassy leguminous crops. *Cirphis loreyi*, Dup., and *C. unipuncta*, Haw., were both present during the year, but were effectively controlled by parasites. Those bred from the larvae included *Goniophana heterocera*, Macq., *Cuphocera varia*, F., *C. pilosa*, Mall., *Sturmia inconspicuoides*, Baran., *Actia nigritula*, Mall., and *Compsilura concinnata sumatrensis*, Tns.

Bufo marinus, which had been introduced from Hawaii [**24** 274], bred successfully in confinement, and over 60,000 young toads have been liberated in different centres.

Balch (R. E.). **Notes on the Wharf Borer** (*Nacerda melanura* **L.**).—*Canad. Ent.* **69** no. 1 pp. 1–5, 7 refs. Orillia, January 1937.

The coniferous timbers of a wharf belonging to a sugar refining company in St. John harbour, New Brunswick, have been found to be riddled by the larvae of *Nacerda melanura*, L. The cosmopolitan distribution of this Oedemerid and records of injury to timber by it are discussed from the literature [*cf. R.A.E.*, A **24** 288, etc.] ; it has been present in Nova Scotia and Ontario for 40 years or more, and although it appears to be far more numerous near the coast, it occurs more than 1,000 miles from the sea. Records suggest that the salts in sea water and urine, and perhaps sugar, may attract the beetles. Large numbers of adults were seen about the wharf at St. John during July and August, but only dead ones towards the end of September. The larvae overwintered in many different stages, the generations apparently overlapping considerably. It is probable that 2 or more years may be necessary for the completion of development in this locality.

Badly attacked timbers were riddled with the larval galleries. No injury was done to piles, or to other timbers that were submerged at high tide, or to any parts fully exposed to drying by sun and wind. The borer appeared to be capable of infesting only wood that was constantly damp owing to poor ventilation, particularly where the summer temperature would also be rather high owing to the heat of the sun on the sheds above the cribwork. Two lots of infested wood were kept in the laboratory from September to April, one in a large tub containing an inch of water and covered with canvas, and the other uncovered in air with a relative humidity of about 50 per cent. The temperature in both cases varied from 50 to 60°F. In the spring, the

larvae were living in both lots, but appeared more healthy and active in the damp wood, where there were two pupae ; there had, however, not been much development in either. Most of the galleries and many of the larvae were in rotten wood, but some larvae were boring in wood that was apparently quite sound, although within about an inch of at least partly rotted wood. In order to ascertain whether the larvae were dependent on fungi attacking the wood, or on the moister conditions prevailing near the rotten areas, cultures were made from apparently sound wood at points where it was penetrated by the galleries. Of the 13 species of fungi obtained, none was of a wood-rotting variety. It is therefore rather probable that the association with fungi is accidental, owing to the preference of both organisms for a similar environment. Although the insect hastens the penetration of the rot and the decay of the wood, it seems unlikely that it will cause much damage except under conditions favourable to the development of rot. The only preservative recommended is creosote applied under pressure. The maximum amount of ventilation should be secured in construction over water or damp ground.

Smith (L. M.). **Biology of the Mealy Plum Aphid,** *Hyalopterus pruni* **(Geoffroy).**—*Hilgardia* **10** no. 7 pp. 167–209, 12 figs., 1 pl., 64 refs. Berkeley, Calif., November 1936.

This paper on *Hyalopterus arundinis*, F. (*pruni*, F.), for which the author considers *Aphis pruni*, Geoffroy, to be an earlier available name, includes a discussion of its synonymy, a brief review of its distribution, descriptions of all its forms and stages, and an account of the results of studies on its bionomics in California, where the only primary food-plant is plum (varieties of *Prunus domestica*).

Oviposition by the sexual females (the only form in which reproduction is not viviparous and parthenogenetic) occurs for about 2 months during late autumn, and the eggs are usually placed in the axils of lateral buds where they are completely hidden. As a result of their position, they are submerged in water for a considerable part of the winter, and this has an important bearing on control by spraying.

In the spring, hatching begins when the daily mean temperature approaches 14°C. [57·2°F.] and is almost complete in 10 days. The various varieties of *Prunus domestica* that serve as primary food-plants are then in different stages of development ; in the common ones, prunes and European plums, the white petals are usually visible beyond the green sepals. The survival of the Aphid depends on the buds having opened so that suitable feeding places will be available. Most of the newly hatched fundatrices are able to establish themselves on the green sepals. At the time of full blossom, all the eggs have hatched. When the calyx begins to lose its succulence, the Aphids move to the lower surface of the young leaves and, about this time, give birth to the first fundatrigeniae. These settle close to the fundatrices, always on the lower surface of the developing leaves. From 3–10 successive generations of fundatrigeniae are produced. They are conspicuously gregarious and cause a rolling of the leaf margins towards the midrib, together with a convexity of the dorsal surface of the leaf. They produce copious honeydew, on which a black smut fungus grows. With the approach of warm summer weather, the fundatrigeniae give birth to young that develop into winged migrants ; these remain on the older lower leaves, while the parent forms

congregate on the new succulent growth. In the inland valleys of central California, the fundatrigeniae are unable to withstand the high mid-summer temperatures, and the trees there are normally quite free from Aphids by the middle of August. In the cooler coastal valleys, however, they may persist till the leaves fall, but the species is unable to survive without the intervention of a secondary food-plant, as the fundatrigeniae and the migrants cannot give rise to oviparous forms.

It was shown experimentally that some physiological change at the fourth moult prevents the winged adult migrant from deriving nourishment from the primary food-plant, so that migration to a secondary food-plant is obligatory. The flight of these Aphids is very weak, but migration has been found to occur normally over distances of some 10–30 miles. Under favourable conditions, the Aphid might thus extend its range at the rate of 60 miles a year, 30 miles being covered by the migrants, and another 30 by the gynoparae and males. In California, the secondary food-plants are *Phragmites communis*, *Typha latifolia*, and, rarely, *T. angustifolia*. Following the arrival of the migrants, from 3 to 10 generations of alienicolae are produced on them. Throughout the autumn, the alienicolae sporadically produce alate gynoparae interspersed with other alienicolae, and, soon after the appearance of the gynoparae in large numbers, a few alate males are born. As winter approaches, the numbers of gynoparae decrease, while those of the males increase to as much as 92 per cent. of the population. The gynoparae fly back to the plum trees, on which they rapidly produce the oviparous females. The flight of the Aphid is non-directive, and horizontal movement is thought to be achieved by means of air currents. The males fly to the plums soon after the gynoparae and often arrive before the oviparous females have matured. Males that matured at the same time as gynoparae have been shown to be able to maintain themselves on the plum leaves until the offspring of these gynoparae have reached maturity. Normal leaf-fall usually begins before the maturation of the oviparous females, and many of them fall to the ground on the leaves. Virgin oviparous females will not oviposit but may live for over a month. Oviposition begins a few hours after pairing.

In California, Japanese plums (*Prunus salicina*) growing close to heavily infested varieties of *P. domestica* were not attacked, and it is thought probable that Japanese varieties and most, if not all, Japanese hybrid varieties of *Prunus* are immune. It was shown experimentally that peach and apricot are able to support gynoparae, males and oviparous females, but field evidence indicates that the alates do not seek these trees in California. Lists are given of the other recorded primary and secondary food-plants, showing whether the records are valid, doubtful or erroneous. *Arundo donax* is attacked in other parts of the world, but not in California. The author concludes that plum is the chief or sole primary food-plant in the colder regions of the temperate zones, whereas peach, apricot and almond are the principal ones in the warmer temperate and tropical regions. A list is also given of the numerous parasites and predators that attack *H. arundinis*, showing the countries concerned. In some areas in California, several Telephorids of the genus *Podabrus* have at times effectively controlled the Aphid on plum, and the parasite, *Praon simulans*, Prov., is present but not effective. Syrphid larvae predominate on *Typha* and Coccinellids and *Leucopis* larvae on *Phragmites*, and the same species also attack the Aphids on plum.

WEBSTER (R. L.). **A Ten Year Study of Codling Moth Activity.**—*Bull. Wash. St. agric. Exp. Sta.* no. 340, 40 pp., 22 figs., 14 refs. Pullman, Wash., October 1936.

The activity of the codling moth [*Cydia pomonella*, L.] on apple in Washington during the 10 years 1926–35 is discussed, with special reference to the effect of temperature on it. The conclusions are similar to those already noticed from a brief account of the first 9 years' work [*R.A.E.*, A **23** 273].

MADER (E. O.) & UDEY (E. C.). **Blooming of Potatoes as influenced by Pyrethrum Dust.**—*Phytopathology* **27** no. 1 pp. 112–113. Lancaster, Pa, January 1937.

It was observed in 1935 that pyrethrum dust, used as an insecticide, had a definite effect on the development of the foliage of potato, and tests in 1936 showed that potato plants treated with pyrethrum produced more blossoms. Pyrethrum applied in addition to Bordeaux mixture practically doubled the number of blossom clusters, and an even greater increase took place when it was used alone. It is thought that some factor other than insect control is involved.

WALKER (J. C.) & LARSON (R. H.). **Increasing Importance of Cabbage Mosaic. (Abstract.)**—*Phytopathology* **27** no. 2 p. 142. Lancaster, Pa, February 1937.

In 1935 and 1936, cabbage mosaic increased in severity on cabbage, cauliflower and flowering broccoli in south-western Wisconsin, especially on late plantings that were exposed to heavy infestation by the cabbage aphis [*Brevicoryne brassicae*, L.], the insect vector. Almost complete dropping of outer leaves reduced yield by as much as 40 per cent. Continued abscission of inner head leaves caused an important storage loss and predisposed the tissue to secondary organisms. Seed productivity was distinctly reduced in a large greenhouse planting.

STUBBS (M. W.). **Certain Viroses of the Garden Pea,** *Pisum sativum.*—*Phytopathology* **27** no. 3 pp. 242–266, 3 figs., 35 refs. Lancaster, Pa, March 1937.

The author briefly reviews the literature on the virus diseases of peas (*Pisum sativum*), and gives the results of investigations on them in Wisconsin in 1933–34. The pea mosaic viruses studied were readily transmitted by *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.), the migration of which from biennial or perennial leguminous hosts of these viruses is the important source of early spring infection.

HOWARD (N. F.), BRANNON (L. W.) & MASON (H. C.). **The Mexican Bean Beetle in the East and its Control.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1624 2nd edn (revd) 20 pp., 15 figs. Washington, D.C., November 1936.

In this revised edition of a bulletin on *Epilachna varivestis*, Muls. (*corrupta*, Muls.) in the eastern part of the United States [*R.A.E.*, A **12** 395; **18** 446], derris or cubé [*Lonchocarpus*] used at a strength to give a spray with 0·015 per cent. rotenone content or cryolite

(sodium fluoaluminate) at the rate of 3 lb. to 50 U.S. gals. water is recommended in place of magnesium arsenate, which causes serious injury to beans. If sprays cannot be applied, derris or cubé dusts with a rotenone content of 0·5 per cent. may be used at the rate of 20–25 lb. to the acre. Derris and cubé, unlike cryolite and other poisonous substances, may be applied to the beans after the pods have begun to form.

Hawkins (J. H.). **The Bionomics and Control of Wireworms in Maine.**—*Bull. Maine agric. Exp. Sta.* no. 381, 146 pp., 13 pls., 18 figs., 8 pp. refs. Orono, Me., April 1936. [Recd. 1937.]

Much of the information in this bulletin on the bionomics and control of wireworms in Maine (based on work from 1926 to 1936) has already been noticed [*cf. R.A.E.*, **22** 389; **23** 373; **25** 29, etc.]. In this State, the average annual loss due to wireworms probably amounts to about £200,000, and in 1930 the loss on potatoes alone was at least £800,000. Lists are given of 48 plants attacked in Maine, and of the 50 species of Elaterids recorded there, of which *Agriotes mancus*, Say, does the most damage, and members of the genera *Melanotus* and *Ludius* are important in that order. Descriptions are given of larvae, and in some cases adults, eggs and pupae, of the species that have been found in Maine in the larval stage.

The life-cycle of *A. mancus* [*cf.* **17** 70] requires at least 3 or 4 years, and the egg and pupal stages last 18 and 17 days, respectively. Adults of *Melanotus* spp. have been taken in the field from late April until mid-July, and eggs laid in July began to hatch in late August, in which month the majority of pupae were also found.

Although kainit was toxic to wireworms when used in large amounts, consistent results were not obtained in the field. Magnesium chloride and magnesium sulphate were effective in the laboratory, particularly at concentrations of 1 : 23 and 1 : 19·5, respectively. Unsatisfactory results were obtained with paradichlorobenzene, calcium chloride, lime, powdered tobacco, and calcium cyanamide in the field, and with mercurous chloride (calomel), sulphur and carbon tetrachloride in the laboratory. Baits of clover, cut and placed in the soil, were the most attractive for *A. mancus*, but in most cases poisons acted as repellents. The most important parasite of *A. mancus* was a Nematode, *Hexamermis* sp., which inhibited the development of the eggs of the host. Other natural enemies include Carabids, Staphylinids, spiders and birds.

Stanley (W. W.). **Studies of the Ecology and Control of Cutworms in Tennessee.**—*Bull. Tenn. agric. Exp. Sta.* no. 159, 16 pp., 5 figs., 7 refs. Knoxville, Tenn., October 1936.

Investigations on the factors affecting the abundance of cutworms in Tennessee and experiments on the use of poison baits for their control are described. Light-trap studies over a 7-year period showed that the moths occur from early April to late December and that they are most numerous in the last week of August and the first week of September. They are most abundant when the annual rainfall is about normal, precipitation above or below the average tending to decrease the numbers caught. *Feltia ducens*, Wlk., and *F. subgothica*, Haw., the two most important species in Tennessee, are more affected by rainfall and relative humidity than by temperature. Light rainfall

during September, October and November, and a low relative humidity in October, when the eggs are laid, provide favourable conditions for the increase of *F. ducens*, whereas *F. subgothica* increases in numbers when the autumn is wet, especially if the rest of the season is dry. A high temperature in August increases the abundance of the moths, and a low relative humidity is required in September, when they are in flight. Experiments on the rate of development of all stages at different constant temperatures were made with *F. ducens*, *F. subgothica*, *F. annexa*, Treit., *Caenurgia erechtea*, Cram., *Laphygma frugiperda*, S. & A., *Polia renigera*, Steph., and *Prodenia ornithogalli*, Gn. In general, higher temperatures accelerated development of all stages, except the prepupal stage of *F. ducens* and *F. subgothica*. These two moths, unlike the others, have only one generation a year, and high temperature increased the duration of the prepupal stage in them, thus compensating for the acceleration it produced in the other stages [*cf. R.A.E.*, A **15** 185]. Climographs for Canada and Tennessee illustrate the extremes of climatic conditions under which *F. ducens* can exist; in Tennessee it enters the prepupal stage early in May and maximum flight occurs about 20th September, whereas in Canada the corresponding dates are 15th June and 27th July and the prepupal stage is very short.

Experiments on the control of cutworms with poisoned baits of coarse wheat bran moistened with water showed that a mixture of 1 part poison to 50 parts dry bran by weight was the most efficient. The percentage mortalities when the poisons were used at this concentration were 61 for Paris green, 59 for sodium arsenite, 40 for white arsenic, and 80·6 for sodium fluosilicate. In a comparative test, with unpoisoned bran available, the larvae seemed to be somewhat repelled by the bait containing sodium arsenite, but fed continuously on that containing sodium fluosilicate. Field tests with sodium fluosilicate also gave excellent results.

Marcovitch (S.) & Stanley (W. W.). **Control of Tobacco Insects in Tennessee.**—*Bull. Tenn. agric. Exp. Sta.* no. 160, 14 pp., 2 refs., 16 figs. Knoxville, Tenn., January 1937.

A short account is given of the bionomics of the chief pests of tobacco in Tennessee and measures for their control. Dusting with Alorco cryolite [*R.A.E.*, A **25** 28] is recommended against *Protoparce* (*Phlegethontius*) *sexta*, Joh., and *Epitrix parvula*, F., and the use of a bait of 1 part cryolite or lead arsenate mixed with 75 parts of maize meal against *Heliothis virescens*, F. (tobacco budworm). The larvae of this Noctuid appear soon after the plants have become established in the field, and a pinch of the bait should then be placed in each bud.

Entomological Investigations.—*Rep. Coun. sci. industr. Res. Aust.* **10** (1935–36) pp. 22–30. Canberra, 1936.

Infestation of peach by *Cydia molesta*, Busck, in Australia has steadily increased, the loss in 1935–36 being estimated as 50–52 per cent. of the crop. The first and second broods cause extensive damage to the young succulent tips, the third and fourth attack the fruit, and injury to quinces and the late season's growth is due to the fifth [*cf. R.A.E.*, A **23** 725]. Field spraying experiments have shown that nicotine sulphate is effective both as an ovicide and larvicide,

but remains so for only a short time. In 1935–36, a mixture of nicotine sulphate and Kolofog (bentonite clay fused with sulphur), tested in the field as a spray, retained its toxicity for as long as 29 days. It acted as a deterrent to oviposition, as an ovicide and as a larvicide. Numerous species of grasshoppers have been studied in the laboratory and the egg characters of many of them are known, so that examination of the egg beds will make identification possible. Special attention is to be paid to *Chortoicetes terminifera*, Wlk., in the central west regions of New South Wales, where most of the swarms of eastern Australia appear to originate. In the northern parts of Australia, pasture-eating species of termites are causing considerable injury, and termite mounds are a source of danger in aerodromes.

Oncopera rufobrunnea, Tindale, is now spreading in various parts of the Federal Capital Territory. Owing to bad weather, only a small supply of the Tachinid parasite, *Hexamera*, was obtained from New Zealand, and it has not been recovered from places in Victoria where it was previously liberated against *Oncopera* [**24** 378]. The common European toad, *Bufo bufo*, has been introduced from England. It feeds readily on larvae, pupae and adults of *Oncopera*, but further tests are to be carried out under quarantine conditions before it is liberated. Observations on the control of *Smynthurus viridis*, L., by the predatory mite, *Biscirus lapidarius*, Kramer [**24** 134] have been continued ; supplies of the mite are to be liberated in New South Wales and again in Victoria. Further attempts have been made to establish *Leucopis obscura*, Hal., on pines infested with *Chermes* (*Pineus*) *pini*, L., and consignments of *Hemerobius stigma*, Steph., *H. nitidulus*, F., *Wesmaëlius concinnus*, Steph., and *Exochomus quadripustulatus*, L., have been introduced. A native Coccinellid, *Scymnus pumilio*, Weise, which is also predacious on *C. pini*, is becoming more abundant in pine plantations in the Federal Capital Territory, and supplies of it have been sent to New Zealand. *Habrolepis dalmanni*, Westw., parasitising *Asterolecanium variolosum*, Ratz. (oak scale), has become established at Launceston and was found to have attacked 50 per cent. of the scales on a sample of infested twigs. *Encarsia formosa*, Gah., which was introduced for the control of *Trialeurodes vaporariorum*, Westw., is well established, and has been found 200 miles away from the nearest point of liberation. *Lampyris noctiluca*, L., the larvae of which feed exclusively on snails, has been introduced for use against *Helix aspersa*, and is being successfully bred.

Of the insects that have been imported for the control of St. John's Wort (*Hypericum perforatum*) [*cf.* **24** 377, etc.], *Chrysomela varians*, Schaller, *C. brunsvicensis*, Grav., and *C. hyperici*, Forst., have failed to become established. A fourth species, *C. geminata*, Payk., is being tested in the south of France ; it aestivates during dry hot weather and is thought to have a better chance of survival than those already introduced. From 1,500 overwintering larvae of *Lathronympha hypericana*, Hb., sent from England, only 30 adults were reared and these died without ovipositing. Studies in the south of France showed that larvae of the Buprestid, *Agrilus hyperici*, Crtz., do considerable damage to St. John's Wort by burrowing in the stems and roots. Further liberations have been made of *Euaresta aequalis*, Lw., against Noogoora burr (*Xanthium pungens*). In Fiji, the lantana bug, *Teleonemia lantanae*, Dist., is attacked by a fungus in wet weather [*cf.* **24** 447]. A consignment of the bugs was sent to Canberra, where they are being successfully bred, the fungus not having appeared there. Small

consignments of *Bactra truculenta*, Meyr., and *Athesapeuta cyperi*, Mshl., have been introduced from Hawaii for the control of nut grass (*Cyperus rotundus*), and are being bred under laboratory conditions.

VEITCH (R.). **Report of the Chief Entomologist.**—*Rep. Dep. Agric. Qd 1935–36* pp. 89–94, 19 refs. Brisbane, 1936.

Chortoicetes (*Calataria*) *terminifera*, Wlk., was not sufficiently numerous to cause loss of crops or pastures in Queensland in 1935–36 [*cf. R.A.E.*, A **24** 196]. In November and December, there was a widespread outbreak of *Nysius vinitor*, Bergr., on passion vine [*Passiflora*], pineapple, grape-vines, vegetable crops and cotton, but the total damage caused was not very considerable. As this bug breeds freely on weeds, particularly *Gnaphalium purpureum*, it is difficult to control, and various contact sprays and dusts of nicotine all gave inconclusive results. The polyphagous Galerucid, *Monolepta rosea*, Blkb., occurred in enormous numbers in isolated areas, the plants attacked including fruit trees, cotton and maize. Flares can be effectively employed in controlling an outbreak in its early stages [**24** 329], and a spray containing resin, sodium hydroxide and fish oil gave satisfactory results. *Heliothis armigera*, Hb. (*obsoleta*, F.) seriously injured cotton sown in November and December, and crops planted in January were almost totally destroyed [*cf.* **24** 71], the damage being augmented by a severe infestation by Jassids (*Empoasca* spp.). Experiments on the control of *H. armigera* by arsenical dusts gave promising results and showed that these are also of some value against *Earias huegeli*, Rogenh. (rough bollworm), *Bucculatrix gossypii*, Turn. (cotton leaf-perforator), and certain other species of leaf-eating caterpillars. Infestation by *Platyedra scutigera*, Holdaway, was only appreciable on poor cotton, chiefly in diseased bolls. *Loxostege affinitalis*, Led. (cotton web-spinner) appeared as an important pest for the first time since the revival of cotton-growing some 15 years ago. It was also very numerous on *Atriplex muelleri*, and other food-plants. *Nezara viridula*, L., was more abundant than usual on vegetables and on leguminous weeds in a cotton field. Its egg parasite, *Microphanurus megacephalus*, Ashm., a consignment of which was introduced from Western Australia, was bred in the laboratory and liberated. Promising results were obtained with sulphur dust against *Phyllocoptes* sp., which has recently become a major pest on tomato. It has been determined that the silvering of bananas is not due to *Thrips imaginis*, Bagn. [*cf.* **24** 197], but to an unidentified thrips that also feeds on the weed, *Passiflora suberosa* ; the degree of infestation of bananas appears to be directly correlated with the abundance of the weed. Investigations are being continued into the life-history of *Pseudomydaus* (*Decilaus*) *citriperda*, Tryon (citrus root bark channeller). In an apiary that was attacked by *Pediculoides ventricosus*, Newp., the brood in 19 of the infested hives died out.

SCOTT (R. C.). **Prickly Pear Eradication.**—*J. Dep. Agric. S. Aust.* **40** no. 5 pp. 404–410, 6 figs., 2 refs. Adelaide, December 1936.

Early in 1934, 50,000 eggs of *Cactoblastis cactorum*, Berg, were introduced into South Australia from Queensland [*cf. R.A.E.*, A **25** 298, etc.] for the control of *Opuntia monocantha* (smooth tree pear), but, although the larvae were fairly plentiful in August, none was to be

found by October 1935. *Dactylopius ceylonicus*, Green (*indicus*, Green) [*cf.* **22** 380], which was also introduced from Queensland early in 1934, became successfully established, and by February 1936 it had become very effective in destroying *O. monocantha*.

SIMMONDS (H. W.). **Entomology Division—Annual Report, 1935.**—*Ann. Bull. divl Reps Dep. Agric. Fiji 1935* pp. 19–22. Suva, 1936.

Some of the information in this report on work in Fiji in 1935 has already been noticed [*R.A.E.*, A **24** 446, 447, 767]. Abnormally wet conditions greatly handicapped all field work in Suva. Coconut pests included the Phasmid, *Graeffea cocophaga*, Newp.; *Promecotheca reichei*, Baly, a local outbreak of which was suppressed by *Pleurotropis parvulus*, Ferrière [*cf.* **25** 191]; and *Tirathaba trichogramma*, Meyr., in the control of which *Apanteles tirathabae*, Wlkn., and *Nemeritis palmaris*, Wlkn., appeared to be valuable. More than 12,000 females of the Javanese species of *Cremastus* parasitic on the banana scab moth, *Nacoleia octasema*, Meyr., have been released [*cf.* **24** 121, etc.], but it has only once been recovered, and work with it has therefore been abandoned. As the moth also breeds on *Pandanus* flowers and *Alpinia boas*, it is able to spread from these wild plants to new stands of bananas and is therefore difficult to control.

The Aphelinid, *Aneristus ceroplastae*, How., and an undetermined Encyrtid have been bred from *Ceroplastes rubens*, Mask., which, although generally distributed throughout the jungle, causes no damage in Fiji to *Citrus*, on which it is very seldom observed. *Citrus* was, however, attacked by *Lecanium* sp., and by *Fiorinia proboscidaria*, Green, a Coccid hitherto recorded only from Ceylon. Coffee berries were slightly attacked by an undetermined Scolytid, and the fruit-fly, *Dacus* (*Chaetodacus*) *passiflorae*, Frogg., was twice bred from them. The control of *Clidemia hirta* by *Liothrips urichi*, Karny [*cf.* **24** 121] is proceeding satisfactorily, the weed having almost disappeared over large areas. The importation of small consignments of the Curculionid, *Athesapeuta cyperi*, Mshl., and the moth, *Bactra truculenta*, Meyr., from Hawaii for the control of nut grass [*Cyperus rotundus*] did not give satisfactory results, but it is hoped to obtain further shipments. The larvae of *Hymenia recurvalis*, F. (*fascialis*, Stoll) cause great damage to beet, *Amarantus*, and allied plants, despite parasitism by *Apanteles hymeniae*, Wlkn. A consignment of 670 adults of the Ichneumonid, *Cremastus flavoorbitalis*, Cam., was imported from Hawaii and released for the control of various Pyralids, and one generation was completed in the field. Larvae of the Coccinellid, *Rodolia* (*Vedalia*) *cardinalis*, Muls., were found attacking *Icerya seychellarum*, Westw., on palms, *Citrus* and other plants.

Consignments of beneficial insects despatched overseas [**24** 447] included one of *Teleonemia lantanae*, Dist., sent to Sydney for use in the control of *Lantana*.

VILLENEUVE DE JANTI (J.). **Myodaires supérieurs africains récoltés à Kampala (Uganda) par M. H. Hargreaves.**—*Bull. Soc. ent. Belg.* **76** fasc. 12 pp. 415–419, 1 fig. Brussels, December 1936.

Records are given of 10 species of Diptera taken in Uganda by H. Hargreaves, of which 6 are described as new. They include *Bogosiella*

fasciata, F., *Sarcophaga dispessa*, sp. n., and *S. dysderci*, sp. n., reared from *Dysdercus* spp., and *Stomatomyia acuminata*, Rond., which was thought also to be a parasite of *Dysdercus*.

VAN DEN BRUEL (W. E.). **Notes complémentaires sur** *Napomyza lateralis* **Fall.**—*Bull. Soc. ent. Belg.* **76** fasc. 12 pp. 441–455, 3 figs., 9 refs. Brussels, December 1936.

Notes are given on further observations [*cf. R.A.E.*, A **21** 215] of *Phytomyza* (*Napomyza*) *lateralis*, Fall., which infests chicory (*Cichorium intybus*) near Brussels, and causes a loss of about 10 per cent. of the crop in some places. It is generally more abundant in chicory in Belgium than *Agromyza* (*Ophiomyia*) *pinguis*, Fall., but the relative prevalence of the two species fluctuated from 1931 to 1936, and *A. pinguis* was the more abundant in 1934–35. This variation was probably due to a complementary fluctuation in the abundance of parasites. *P. lateralis* was very resistant to cold, some of the pupae withstanding −14·9°C. [5·18°F.]. Observations of limited numbers of heavily infested plants in different stages of growth showed that in the roots the number of pupae remained constant during the development of the plant and the number of larvae decreased, while in the leaves the numbers of both increased. During the process of development, the larvae migrate to the leaves. Weakened tissues and those deficient in chlorophyll are mostly attacked. The author suggests that although the greater part of the infestation of chicory in forcing beds is through the introduction of larvae in the roots [*loc. cit.*], some part may be due to oviposition on the exposed points of the plants. All stages except the adult appeared to be present in the plants before overwintering. In the laboratory, adults would not feed on chicory in the dark, but attacked the plants vigorously in the light. The feeding punctures of *A. pinguis* are similar to those of *P. lateralis*. Eggs of the latter were laid in the leaves, and 28 were found in one dissected female. In 1935, most of the adults emerged 70 days after the introduction of the plants into the cage, and the maximum pupal period was 20 days. In 1936, development in the laboratory took 51 days at 17–25°C. [62·6–77·0°F.], and the adults first emerged on 7th May. One female laid about 50 eggs, which hatched in 44–58 days. The results of this experiment confirmed previous observations that *P. lateralis* generally oviposits on the root-collar of the plant. It is probable that there are 3 generations during the year, the adults appearing in late March and April, May–June, and August–October, or, if the emergence of the first generation is prolonged, only two generations and part of a third.

MORSTATT (H.). **Kaffee-Schädlinge und -Krankheiten Afrikas. V. Beschädigungen der Wurzeln. VI. Beschädigungen in Saatbeeten, an Keimpflanzen und an jungen Bäumen.** [Coffee Pests and Diseases in Africa. V. Injuries to the Roots. VI. Injuries to Seed Beds, Seedlings, and young Trees.]—*Tropenpflanzer* **40** no. 2 pp. 47–65, 8 figs. Berlin, February 1937.

The pests dealt with in this concluding article of a series [*R.A.E.*, A **25** 81, etc.] include mealybugs attacking the roots, and Gryllids, termites, cutworms, and Tenebrionids attacking young plants.

MARCHAL (P.). **Recherches sur la biologie et le développement des Hymenoptères parasites. Les Trichogrammes.**—*Ann. Epiphyt. Phytogén.* N.S. **2** fasc. 4 pp. 447–550, 23 figs., 1 col. pl., 72 refs. Paris, 1936.

In this paper on work on *Trichogramma evanescens*, Westw., *T. cacoeciae*, Marchal, and a race of the latter which the author calls *flavum*, taken in two districts of France, much of which has already been noticed [*R.A.E.*, A **15** 653], an account is given of further experiments on crossing the forms. Females of *T. evanescens* paired with males of *flavum*, but the sex of the progeny was not affected. Pairing did not take place between females of *T. evanescens* and males of *T. cacoeciae*, but the author does not consider this experiment conclusive, as very few males were available. Further methods of modifying the life-cycle of *T. cacoeciae*, and the causes, other than cold, of micropterism and irregularity in wing development and other differences between the winter and summer generations are described, and the occasional appearance of males is discussed. In captivity, *T. cacoeciae* oviposited in eggs of various Lepidoptera, including those of *Tortrix* (*Cacoecia*) *rosana*, L., killed during development by a damp heat of 50–70°C. [122–158°F.] or boiling water, the eggs developing normally if the heat to which the host eggs had been subjected had not exceeded 60°C. [140°F.] and dying if it had reached 70°C. It would not, however, oviposit in eggs of *Tortrix* during the summer period that corresponds to the state of diapause. This is attributed to the suspension of chemical reactions in such eggs.

The race *flavum*, which was collected in central France [**15** 654] in eggs of an unidentified Microlepidopteron, was reared through 28 consecutive generations in 4 years on various hosts, all individuals from the second generation onwards belonging to a pure line descended from one parent. In the 28 generations, 6 males were seen. A smaller proportion of this race than of *T. cacoeciae* survives the winter in the diapause generation. Micropterism occurs as in the typical form.

The true *T. evanescens*, which has been found in many parts of France, is more active and required a higher temperature than *T. cacoeciae*, the spring generation emerging a month later than that of the latter. Observations on the life-cycle and hibernation are described, the different forms of males developing both in eggs of *Sialis* and in those of Lepidoptera are discussed, and a connection between parthenogenetic development and micropterism is suggested. Although unfertilised females of *T. evanescens* normally produced males, five successive generations (3–7) with only one male were bred mainly in *Ephestia* from an original stock with more than 50 per cent. males, taken in eggs of *Sialis*. In experiments, *T. evanescens* would not oviposit in eggs of *Tortrix* in diapause, but in the case of eggs not in diapause, some positive and some negative results were obtained, though in no instance did the egg of the parasite hatch. The results were positive only when the adults were freshly emerged and the host eggs just laid. It would appear that adults allowed to remain too long in association with eggs of a certain species, or with the shells from which they have emerged, become indifferent to eggs of another species.

A chapter is devoted to notes on observations made on various other strains of *Trichogramma*, associated with *Cydia* (*Carpocapsa*) *pomonella*, L., *Pyrausta nubilalis*, Hb., *Clysia ambiguella*, Hb., and

Polychrosis botrana, Schiff., and in the last chapter, on abnormal behaviour of *Trichogramma*, the question of false hosts [*cf.* **23** 390] is discussed.

SMITH (H. D.). **Le Syrphide *Xanthandrus comtus* Harris prédateur de la Chenille processionnaire du Pin.**—*Bull. Soc. ent. Fr.* **41** no. 20 pp. 328–329, 1 ref. Paris, 1937.

Larvae of the Syrphid, *Xanthandrus comtus*, Harris, which are generally predacious on Aphids, were found in the nests of *Thaumetopoea* (*Cnethocampa*) *pinivora*, Treit., in a forest of Aleppo pine [*Pinus halepensis*] in the south of Var, France. Examination of twelve nests showed that all the caterpillars were living and no Syrphids were present in one ; most of the caterpillars were dead and some Syrphids were present in six ; and all the caterpillars were dead with typical Syrphid injury in five (one of which contained 80 caterpillars), but only traces of the predators (pupal skins, etc.) remained. The caterpillars in these nests were all about 1 cm. long, and most of the Syrphids taken from them had completed the larval stage. In the laboratory, larvae of *X. comtus* sucked the body fluids of caterpillars 2 cm. long. They pupated after several days, and the adults emerged 2 weeks later. In one instance, the Syrphids were observed feeding on the caterpillars in a nest also containing Aphids, which were not attacked.

X. comtus was not taken from nests collected in the north of Var.

MASERA (E.). **Le malattie infettive degli insetti e loro indice bibliografico.** [Infectious Diseases of Insects and a Bibliographical Index to them.]—Med. 8vo, 343 pp., 46 figs., 229 pp. refs. Bologna, L. Capelli, 1936. [Recd. March 1937.]

Some 100 pages of this work are devoted to a survey of information on the diseases of insects caused by protozoa, bacteria, viruses and fungi, with special chapters on the silkworm (*Bombyx mori*, L.) and the honey-bee, and the remainder comprises a classified bibliography covering most of the papers published on the subject.

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